

50X1-HUM

DIESEL ENGINE AND DIESEL-COMPRESSOR SNORT EXHAUST SYSTEM

**Description and Maintenance
Instructions**

H641-A76-237

50X1-HUM

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1. DESCRIPTIONA. PURPOSE

The snort exhaust system is intended for discharging exhaust gases from each of three diesel engines 2A42 and two diesel engines 2A41 to overboard or to the atmosphere when the submarine is cruising on the surface.

The snort exhaust system also serves as a section of the gas system when diesel engines operate at periscope depth.

Basic Specifications

1. Diameter of outer flange pipe 250 mm
 2. Diameter of inner flange pipe 150 mm
 3. Diameter of exhaust pipe 100 mm
 4. Length of inner pipe 100 mm
 5. Length of outer pipe 100 mm
 6. Length of support 100 mm
 7. Length of gas system 100 mm
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P. GENERAL DESCRIPTION AND DESCRIPTION
 OF MAJOR UNITS

General Description

(Appendices Nos 1, 2 and 3)

The snort exhaust systems of the starboard and port diesel engines are the same in design and therefore the exhaust system of only one side is described herein.

When the submarine is cruising on the surface, exhaust gases of wing diesel engine 2A42 are discharged below the surface through compensator 126, inner pipe bend 124, inner flap 128, the support on the pressure hull, pressure pipe bend 130, outside flap 133, exhaust pipe bend 135 and exhaust pipe 136 furnished with a cowl.

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cooling cavities and is cooled with sea water fed to the cooling pipeline. Cooling water is not fed to pipes 136 and 137 which are located inside the hull, to valves 153 and gate valves 138. For protection, valves 153 and gate valves are coated with anti-rust paint.

The cooling cavities of the short exhaust system inner and outer located inside the pressure hull have been tested for strength and watertightness at a hydraulic pressure of 5 kgf/cm².

The cooling cavities of the units located outside the pressure hull have been tested for weld strength and watertightness at a hydraulic pressure of 0.5 kgf/cm².

Pressure pipe bends 136 and 148 have been tested for strength at a hydraulic pressure of 45 kgf/cm².

The diesel-compressor short exhaust system has been tested for airtightness by air under a pressure of 1.5 kgf/cm².

The test rates for the other units of the short exhaust system are given in the descriptions of these units.

Description of Major Units

Compensator

(Figs 1 and 2 and Appendices 1 and 2)

Compensator 125 ensures flexible coupling between the short exhaust pipe rigidly connected to the submarine pressure hull and the shockproof engine. Such a coupling is obtained with the help of rubber sleeve 6 connecting bodies 3 and 7 which are secured to the diesel engine turbine and the short exhaust system, respectively.

The flexible sleeve is protected against hot gases by means of "air bag", which, in its turn, is protected against exhaust gases by asbestos-cement ring 5. The ring serves as a packing element between bodies 3 and 7.

Thrust straps 4 protect the sleeve against possible bulgings which may be caused by momentary pressure increases in the exhaust gas duct.

Wing engine compensator 126 has water catcher 8 with a capacity of 6 litres.

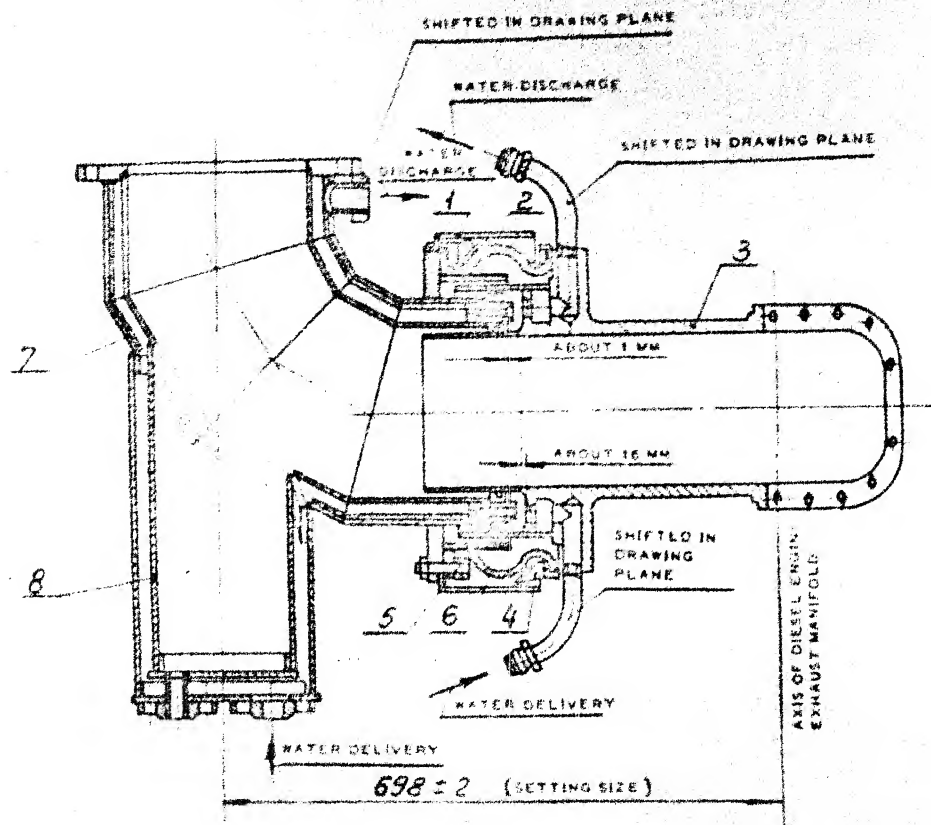


FIG. 1. COMPENSATOR

1-casing; 2-gasket; 3-body; 4-thrust strap; 5-asbestos-cement ring; 6-flexible sleeve; 7-body;
8-water catcher

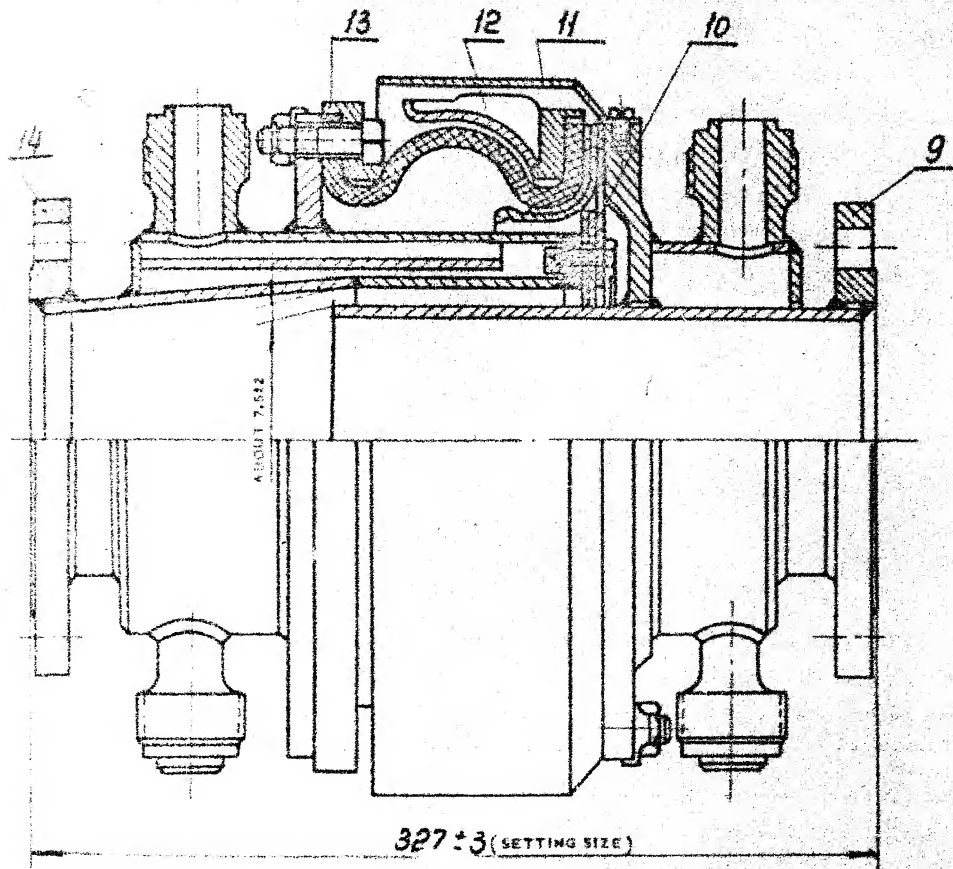


FIG. 2. COMPENSATOR OF DIESEL-COMPRESSOR /JK-2 SNORT EXHAUST SYSTEM

9-body; 10-gasket; 11-casing; 12-flexible sleeve; 13-pressure ring; 14-body

Compensator 127 of the centre short exhaust duct is not furnished with water catcher.

Body 7 of the compensator is welded of special alloy; body 3 is cast of stainless steel.

The gas cavity of assembled compensator 126 has been tested for airtightness at an air pressure of 2.5 kgf/cm^2 . The cooling cavities of bodies 3 and 7 have been tested for strength and airtightness of joints at a hydraulic pressure of 5 kgf/cm^2 .

Compensator 149 of the diesel-compressor and compensator 126 are principally the same in design with only difference that the former has no water catcher and paronite gaskets 10 are used as a sealing element between its bodies 9 and 14.

The compensator bodies are made of steel.

The gas cavity of assembled compensator 149 has been tested for airtightness at an air pressure of 1.5 kgf/cm^2 . The cooling cavities of bodies 9 and 14 have been tested for strength and airtightness of their joints at a hydraulic pressure of 5 kgf/cm^2 .

Inner Flap

(Figs 3, 4, 5 and Appendices 1 and 2)

Inner flap 128 serves as the second pressure lock of the short exhaust system and is secured to the support by the explosion-proof studs.

The flap is opened or closed by pneumatic mechanism 25, which is a part of the flap structure, or by the manual linkage.

Under the action of air pressure piston 49 of the mechanism moves together with rack 50 thus turning gear 52 and shaft 53. The other end of the shaft carries crank 30 which transmits rotation via shackle 31 to crank 32 freely fitted on shaft 26.

Crank 32 by its rests 36 and 37 actuates lever 34, rigidly coupled with shaft 26, turns the shaft and lever 18 coupled with disc 19.

When the mechanism crank passes over its dead point it fixes disc 19 in the closed position. This passage is effected by compression of disc springs 33 installed in rest 37.

In the open position the disc is fixed by ball 21 with a spring mounted in rest 36.

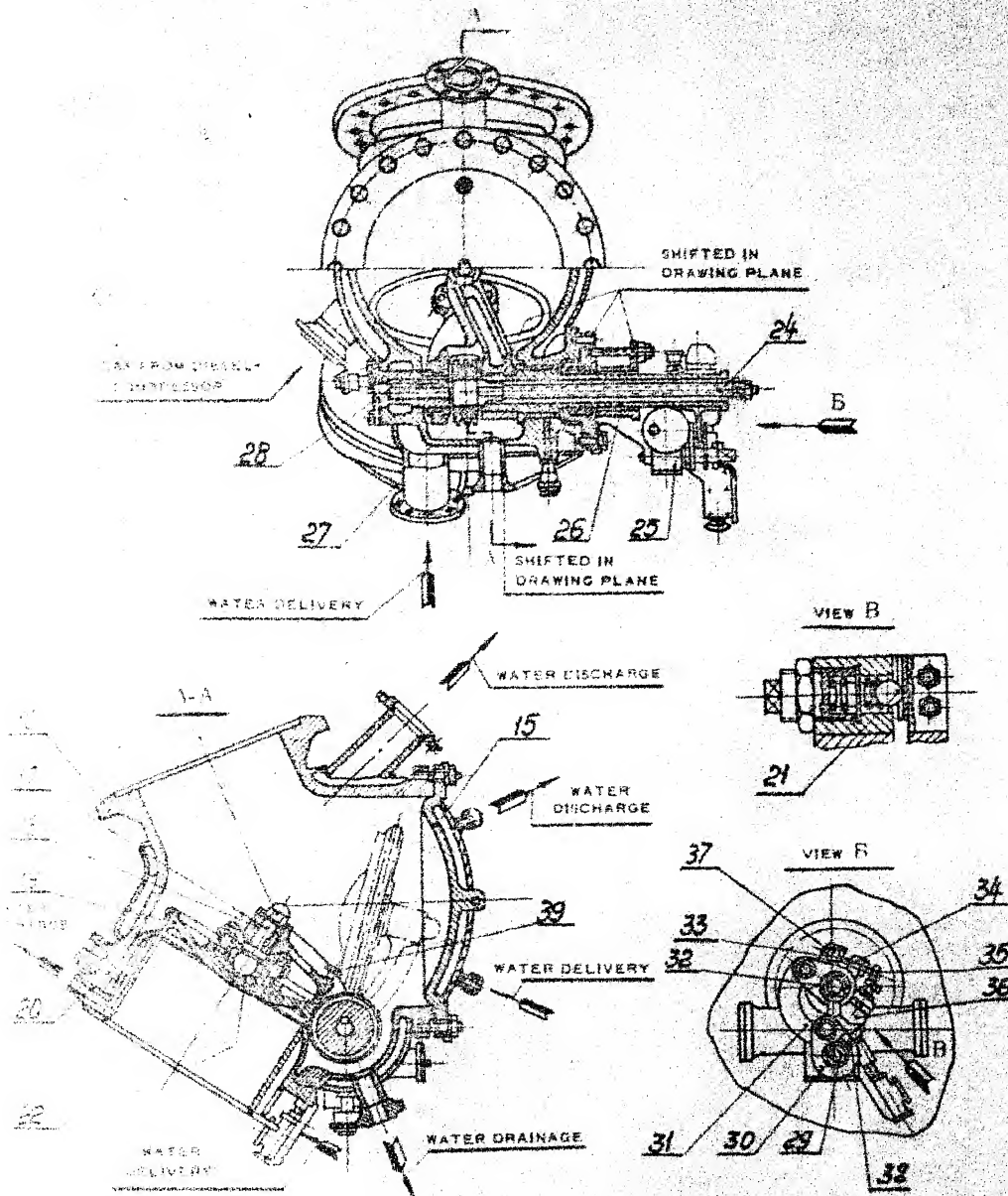
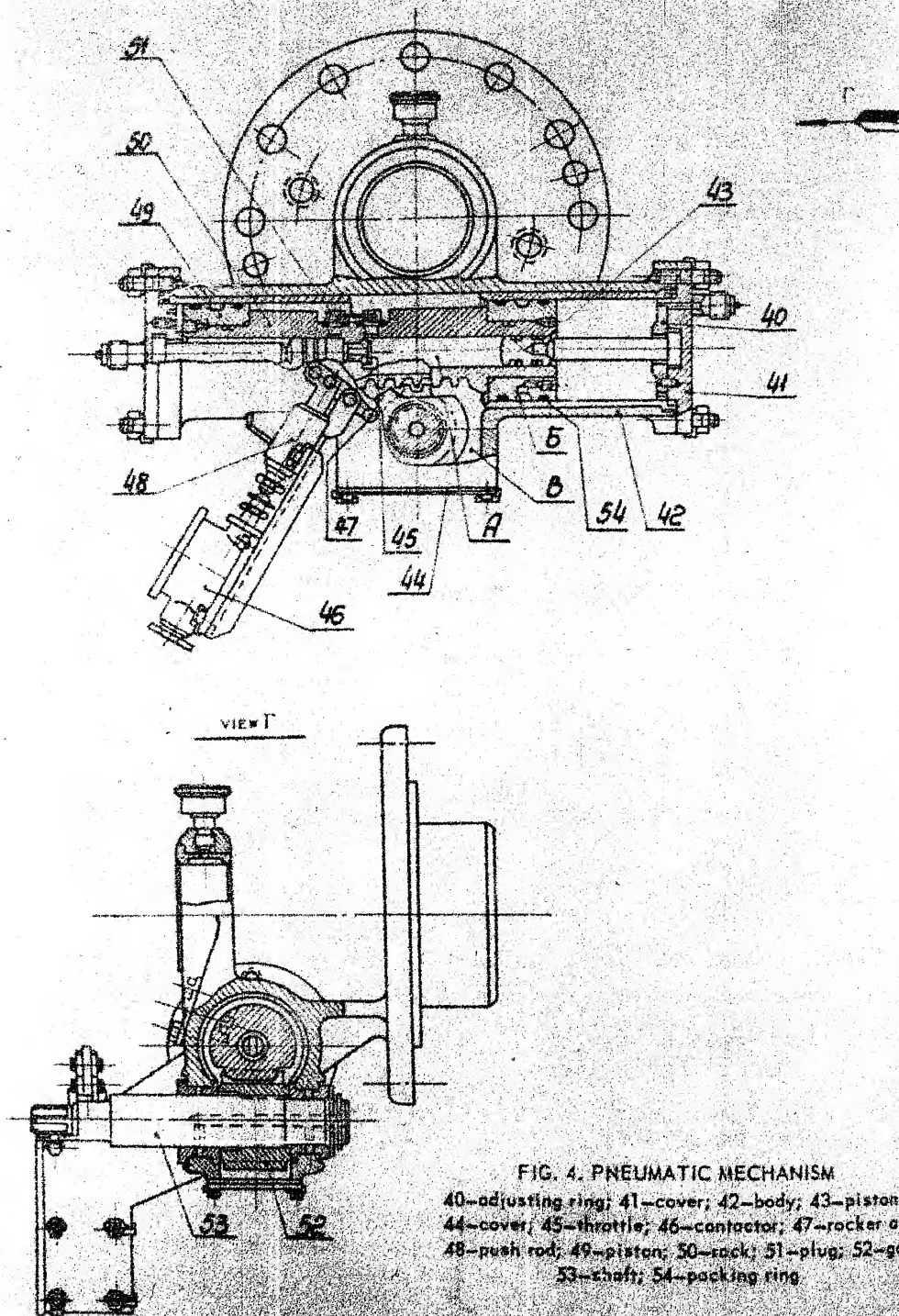


FIG. 3. INNER FLAP

16—housing; 17—spherical pin; 18—lever; 19—disc; 20—coaming; 21—ball; 22—spherical shell; 23—disc; 24—shaft; 25—pneumatic mechanism; 26—hollow shaft; 27—worm; 28—axle; 29—cam; 30—crank; 31—hook; 32—crank; 33—disc spring; 34—lever; 35—adjusting bolt; 36—rest; 37—rest; 38—pounder; 39—adjusting bolt





The pneumatic mechanism is furnished with the damping device to prevent disk 19 from knocking against the coaming. This device is made as an oil damper in which smooth replacement of the disk is obtained due to an oil flow through throttle 45 during the piston stroke.

The damper has plugs 51 to bleed air when its cavities are filled with oil.

Three or four seconds are required for opening or closing the flap; this is obtained by proper selection of holes in throttle washers mounted on the air inlet and outlet of the pneumatic mechanism.

The flap may be opened or closed manually with the help of the lever put on shaft 53.

Open and closed positions of the flap are indicated by the respective light signals or notches marked on cam 29.

Contact 46 of the light signalling system is mounted on the body of the pneumatic mechanism and is actuated by cam 29.

Mounted on the cam are the bolts which press rocker 47 through push rod 48, and actuate the contactor.

Cam 29 bears notches with letters "O" and "3" corresponding to words OPEN (OTKRYTO) and CLOSED (ZAKRYTO), respectively. Indicator 38 aligned with one of the notches marked on cam 29 shows the position of flap 128.

Metal-to-metal packing is used for sealing the flap. The packing margins of disk 19 and coaming 20 are built up of stainless steel.

The flap is furnished with a special cleaning appliance intended for removing carbon deposit from the packing margins. The ratchet of the air supply valve is fitted on shaft 24 and rotates it and worm 27. The worm engages the tooth rim of disk 19. Carbon deposit is removed from the packing margins by disk 19 which is swung by multiple turning handle 23 to the right and to the left at the moment when the disk reaches the coaming.

To eliminate binding of the disk during cleaning, adjusting bolt 39 is mounted on the coaming.

Shafts 24 and 26 of the flap are packed with stuffings made of greased asbestos.

flap housing 16, coaming 20, cover 15 and the cooling
parts made of steel.

Flap gas cavity is furnished with a branch pipe for
the short exhaust duct of diesel-compressor MC-2 and
for draining the flap.

Friction surfaces of the flap parts are lubricated
by pump MK-1 by means of the mechanical plunger lubri-
cator of a flap lubricator.

The assembled flap has been tested for tightness at a hy-
draulic pressure of 38 kgf/cm² applied to the over-valve cavity;
flap gaskets have been tested for strength and watertight-
ness of joints under a hydraulic pressure 5 kgf/cm².

Outer Flap

(Figs 6 and 8, Appendices 1 and 3)

Outer flap 13 serves as the first pressure lock of the
pressure system.

Flap 13 is welded of special alloy and is furnished with
a bucket in its upper part. The lower part of the
flap is a bath for water drained from the housing cooling
cavity.

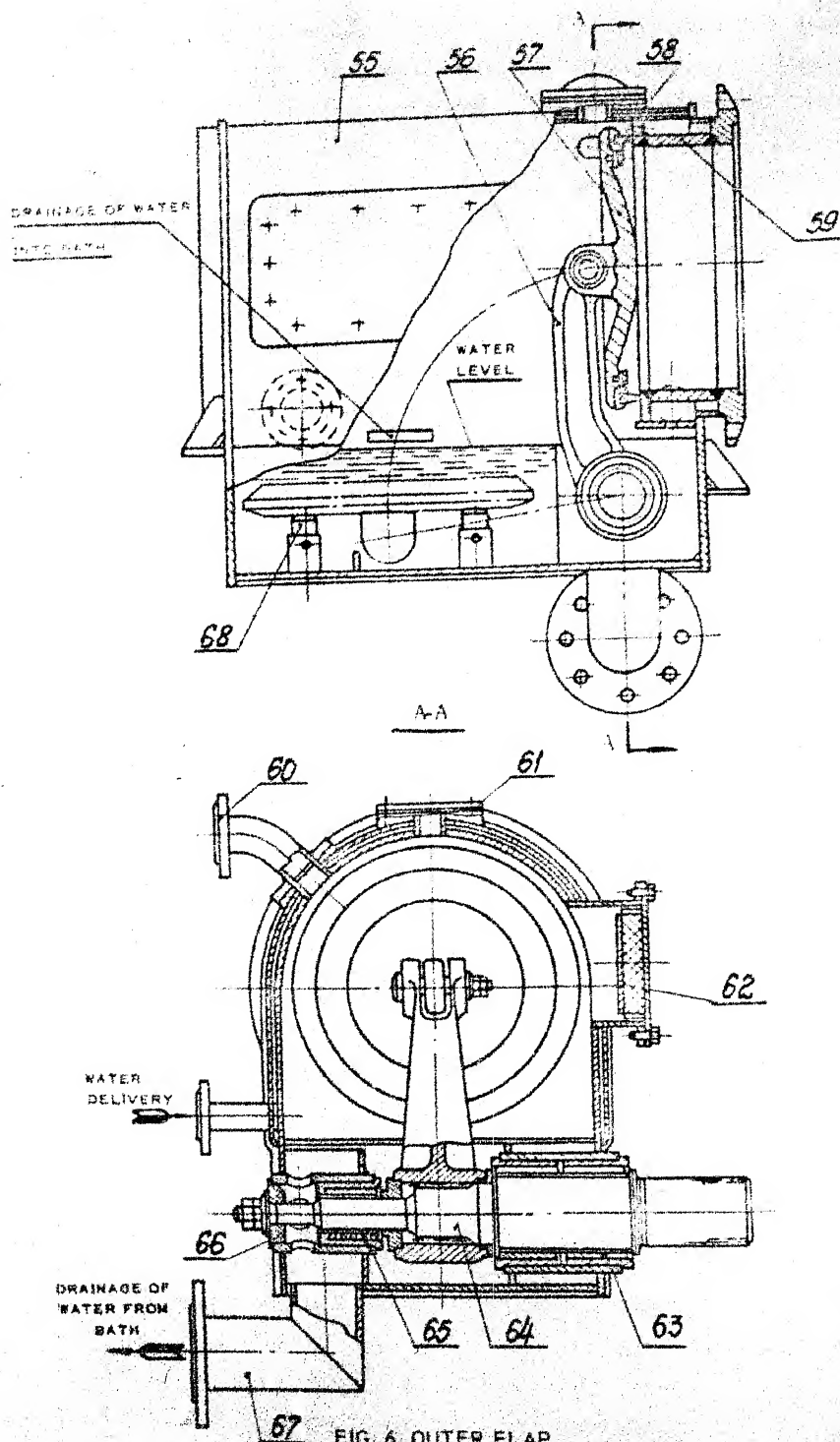
Coaming 59 with its own cooling cavity is welded
to the housing.

The housing and the coaming have their own cooling water
supply pipes.

Water is drained from the housing cooling cavity into the
bath through a hole bored in the housing wall. When the flap is
closed, it immerses into the bath. The bath water protects
the ring 58, bearing shells 63 and 65 against hot gases
coming through the flap.

Required level of water in the bath is ensured by means of
a bucket separated in the bath; excessive water flows over the
edge of the bucket and then through branch pipe 67 it flows
aboard.

The flap housing has the hatch with cover 62. The hatch is
used for internal inspection of the flap and replacement of rub-
ber bearing ring 58.



55-housing; 56-lever; 57-disc; 58-packing ring; 59-coaming; 60-ventilation branch pipe; 61-screw plug; 62-hatch cover; 63-shell; 64-drive shaft; 65-shell; 66-screw plug; 67-branch pipe; 68-buffer

Flap 139 of the centre diesel engine has branch pipe 60 which mounts ventilation valve 132; the upper hole of the flap housing is closed with plug 61.

Flaps 133 of the wing diesel engines are furnished with plugs set instead of branch pipe 60; ventilation pipeline 147 is connected to a welded flange of the upper hole.

Welded into the flap housing are the bearings, whose shells are composed of separate sectors made of wooden-laminated plastic.

The bearings with wooden-laminated plastic shells are lubricated with water contained in the flap bath. The bath should always be flooded with water, otherwise the shaft rotating in the dry bearings may cause scores of the shells.

Mounted on the shaft outlet end is the lever of flap linkage 131.

Fastened to the bottom of the flap housing are buffers 68. The buffers are used to absorb the shocks of the disc against the housing bottom when opening the flap.

Shaft 64 is made of stainless steel and the disc is cast of steel.

The assembled flap has been tested for strength at a hydraulic pressure of 38 kgf/cm² built up in the over-valve space; the cooling cavity has been tested for strength and watertightness of its joints at a hydraulic pressure of 0.5 kgf/cm².

Hydraulic Mechanism

(Figs 7, 8 and Appendices 1 and 2)

Basic Specifications

Working cylinder bore	70 mm
Number of cylinders	2
Cylinder's piston stroke	112 mm
Piston head area	38.5 cm ²
Active volume of cylinder	0.43 lit
Working liquid	Spindle oil
Stem stroke	150 mm
Crank shaft turning angle	195°

Hydraulic mechanism 137 is intended for opening and closing flap 133.

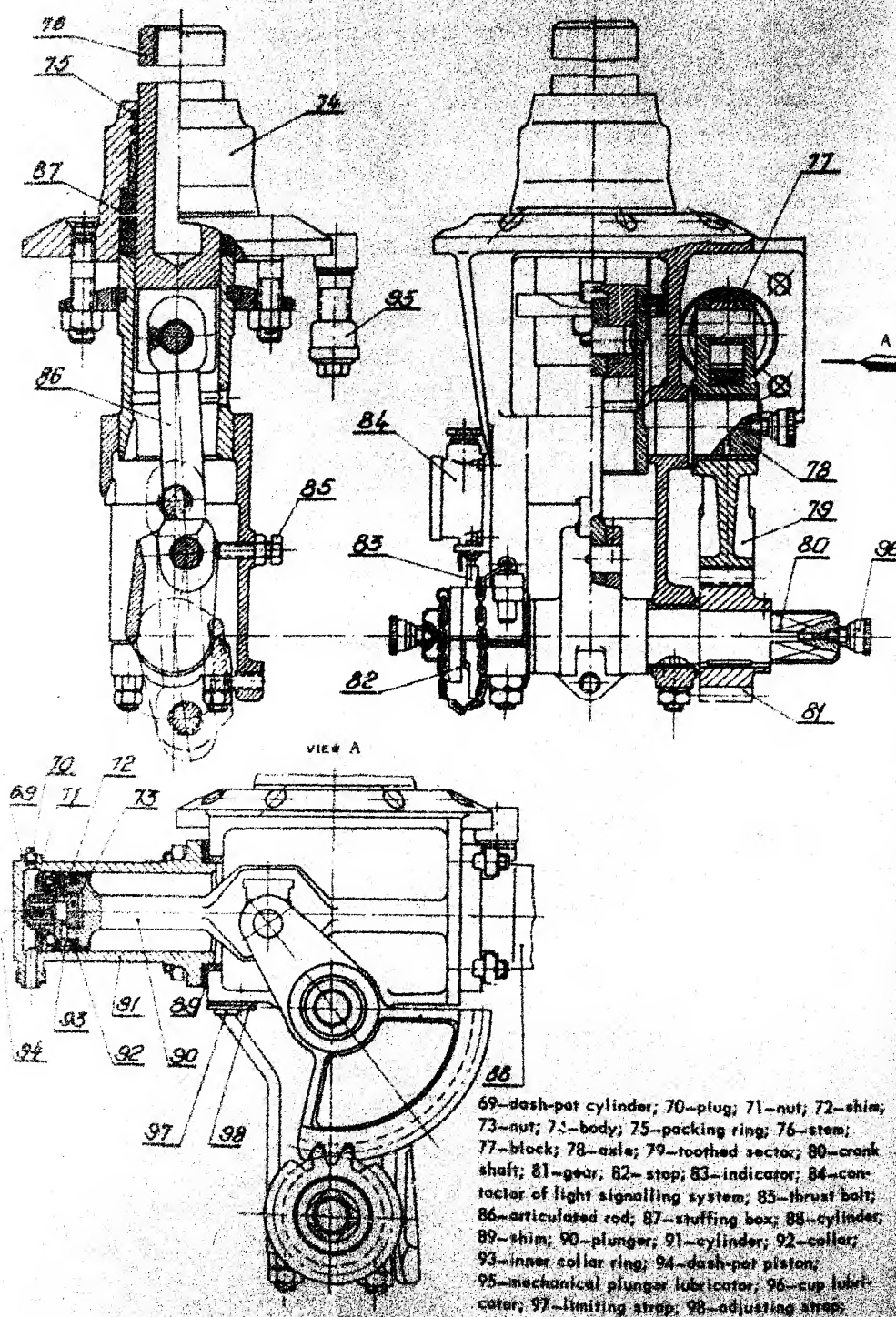


FIG. 7. HYDRAULIC MECHANISM

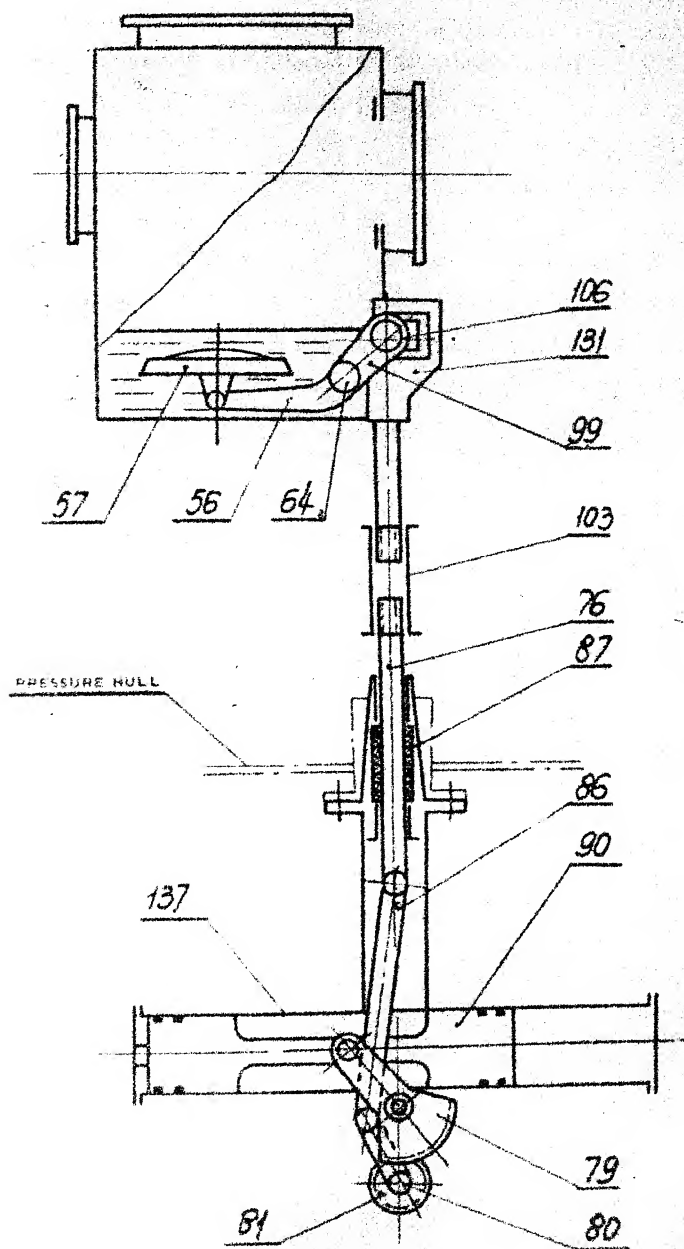


FIG. 8. CONTROL GEARING MECHANISM OF SHORT EXHAUST SYSTEM
OUTER FLAP

Stem 76 of the mechanism passes through the support on the pressure hull into the superstructure. The stem end is secured to linkage 131 of the flap.

Stem 76 is moved upwards under pressure of oil forced into cylinder 88; to move the stem downwards, oil is fed under pressure into cylinder 91. When plunger 90 moves to the right or to the left, it draws block 77 and rotates toothed sector 79, gear 81 and crank shaft 80. The straight motion of stem 76 is caused by the crank shaft through tie-rod 86.

Spontaneous operation of the mechanism under the effect of external forces is precluded by passage of the crank of shaft 80 over dead points at the extreme positions.

The passage value is limited by adjusting bolt 85 and limiting strap 97 with adjusting strap 98.

Possible impacts of the plunger at extreme positions are absorbed by means of dash-pots on both end faces of plunger 90. This is attained owing to an oil cushion formed under dash-pot pistons; the oil cushion throttles through the hole of the dash-pot cylinder thus braking the plunger in the extreme position.

Indicators 82 and 83 located on the mechanism crank shaft show the position (closed or open) of the flap.

When stem 76 lifts or lowers, indicator 83 moves the rod of light signal contactor 84, which sends light signal indicating the flap position to the conning station or to the control post in compartment V; "OPEN" position is indicated by a dull lamp and "CLOSED" one is indicated by a green lamp.

Stem 76 is packed with rubber rings 75 which are under a pressure of sea water when the submarine is submerged. The mechanism is also furnished with stuffing box 87 by the tightening of which the required watertightness may be obtained in those cases when rings 75 do not ensure sufficient tightness of the stem as it enters into the pressure hull.

As a rule, stuffing box 87 should be loosened. In this case a minor effort applied to the lever of the ratchet wrench is required to operate the mechanism manually.

For the manual operation, the mechanism is furnished with a ratchet wrench which is put on the square end of crank shaft 80. To preclude spontaneous operation of the stem, which

may occur during re-setting the ratchet wrench to close the flap, the mechanism is furnished with the locking ratchet-gear (see Ref. Nos 141, 142 and 143, Appendix 1).

During the standstill the mechanism is locked by stop 82 put on the square end of crank shaft 80.

Step 76 is lubricated by means of mechanical plunger lubricator 95. The bearings of crank shaft 80 and toothed sector 79 are lubricated by means of cup lubricators 96.

The hydraulic mechanisms of the snort exhaust system are controlled by means of the control valves installed in the bow section of the diesel engine room.

Outer Flap Linkage

(Figs 8, 9 and Appendix 1)

Flap linkage mechanism 131 converts the forward motion of hydraulic mechanism stem 76 into a rotary motion of shaft 64 of flap 132.

Shackle 100 with fork-insert 105 coupled with stem 76 of the hydraulic mechanism by means of rigging screw 103 and extension arm 104 moves forward and draws lever 99 mounted on the flap shaft. Pin 106 in this case rolls along the horizontal slot of fork-insert 105.

To preclude possible slippages of pin 106 in fork-insert 105, the contact surfaces should not be lubricated.

The linkage is lubricated with AMC-1 lubricant forced by a grease gun into inner cavity of pin 106 through a hole in component 101.

Insignificant mounting misalignments are compensated by the spherical surface of the fork-insert contacting the shackle.

Rigging screw 103 is intended for adjusting the turning angle of outer flap shaft 64; this angle governs the tightness of disc 57 to the pressure coaming of the flap.

The control gearing mechanism of the outer flap of the snort exhaust system is shown in Fig. 8.

Shackle 100, fork-insert 105, pin 106 and rigging screw 103 are made of stainless steel.

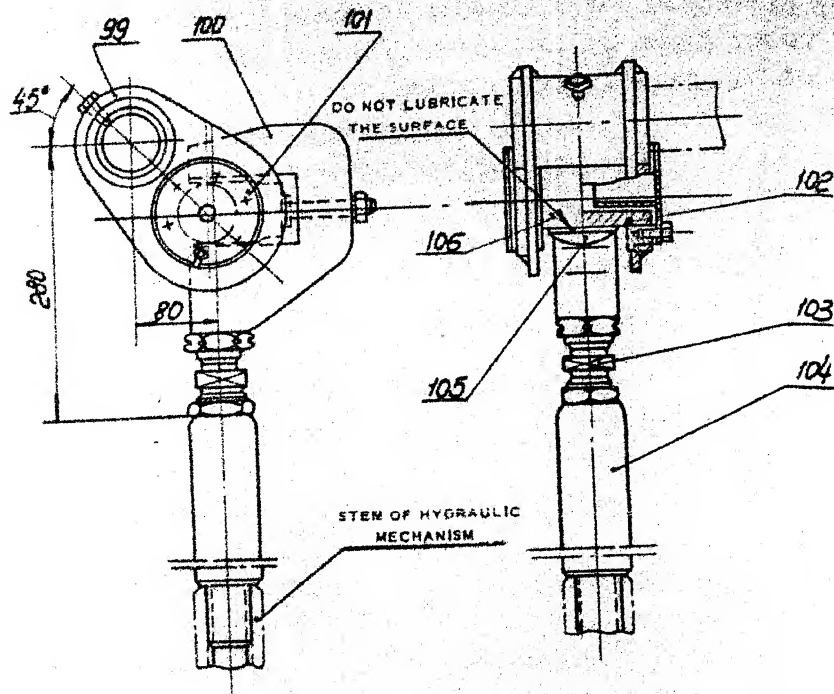


FIG. 9. OUTER FLAP LINKAGE

99-lever; 100-shackle; 101-cover; 102-packing ring; 103-rigging screw;
104-stem extender; 105-fork-insert; 106-pin

Ventilation Valve

(Figs 10, 11, 12 and Appendices 1, 2 and 3)

Ventilation valve 132 is intended for ventilating the light section of the snort exhaust system during submarine diving. The valve is secured to the ventilation branch pipe of outer flap 139 of the centre diesel engine and is connected with outer flaps 133 of the wing diesel engines through ventilation pipelines 147.

Valve body 107 has grooved disc 111 connected with lock disc 110 by means of pin 108. The lock disc is studded to casing 109. The casing has holes for bleeding air when flooding the snort exhaust system.

The snort exhaust system is ventilated when the grooves of disc 111 are matched with grooves of lock disc 110.

The lock disc is controlled manually by means of ventilation valve linkage 155 which is actuated due to the forward motion of stem 114 during rotation of hand wheel 112.

The manual linkage is furnished with mechanical indicator 115 indicating the positions of the valve.

The control gearing mechanism of the ventilation valve is shown in Fig. 12.

The valve is made of stainless steel; the assembled valve has been tested at a hydraulic pressure of 0.1 kgf/cm^2 .

Snort Exhaust Valve of Diesel-Compressor MK-2

(Fig. 13 and Appendix 2)

Diesel-compressor snort exhaust valve 153 serves as the second pressure lock and is installed on inner flap 128 of the wing snort exhaust system near the over-valve space.

The valve is opened and closed manually by means of the hand wheel whose threaded hub axially moves nut 118 with stem 119 carrying disc 117.

Positions of the valve are shown by the mechanical indicator on the valve.

The valve is provided with metal packing. The packing rings of the coaming and disc 117 are built up of stainless steel.

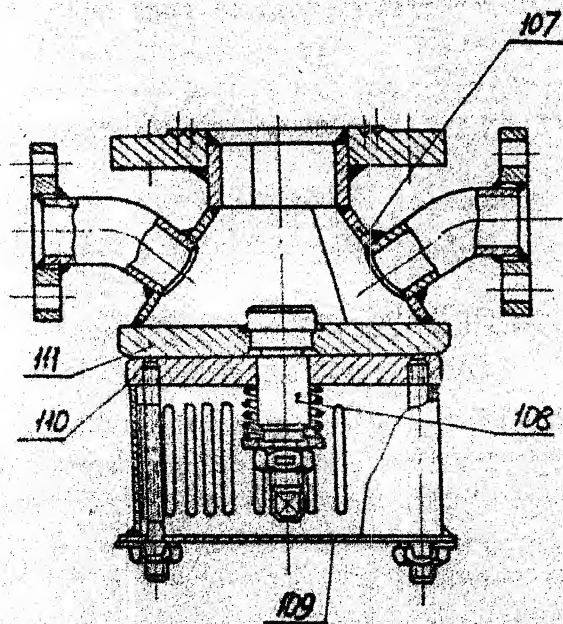
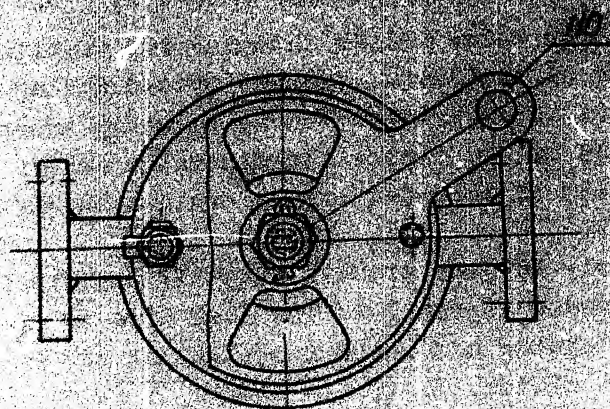


FIG. 10. VENTILATION VALVE

107-body; 108-pin; 109-casing; 110-lock disc; 111-body disc

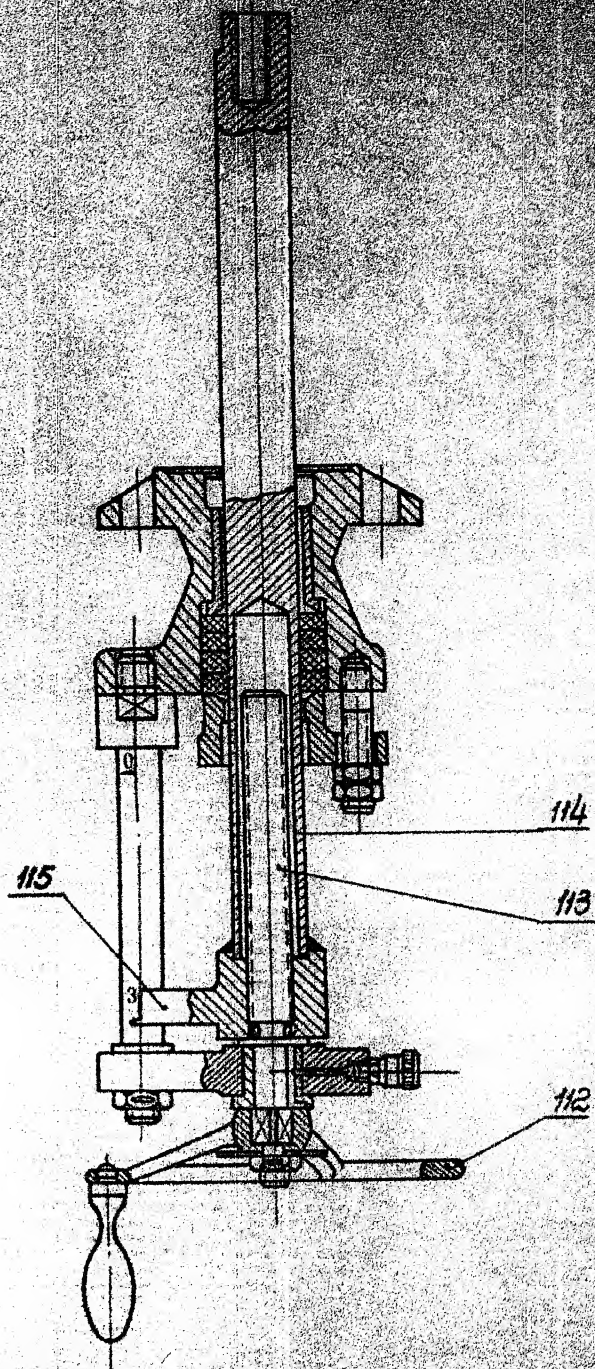


FIG. 11. MANUAL LINKAGE

112—hand wheel; 113—motion screw; 114—stem; 115—mechanical indicator

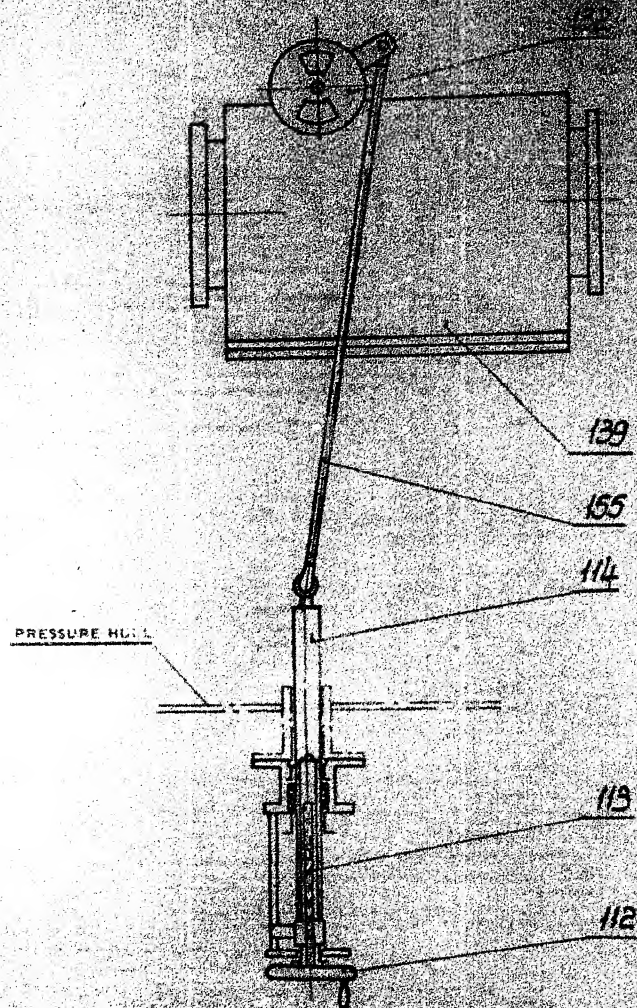


FIG. 12. CONTROL GEARING MECHANISM OF VENTILATION VALVE

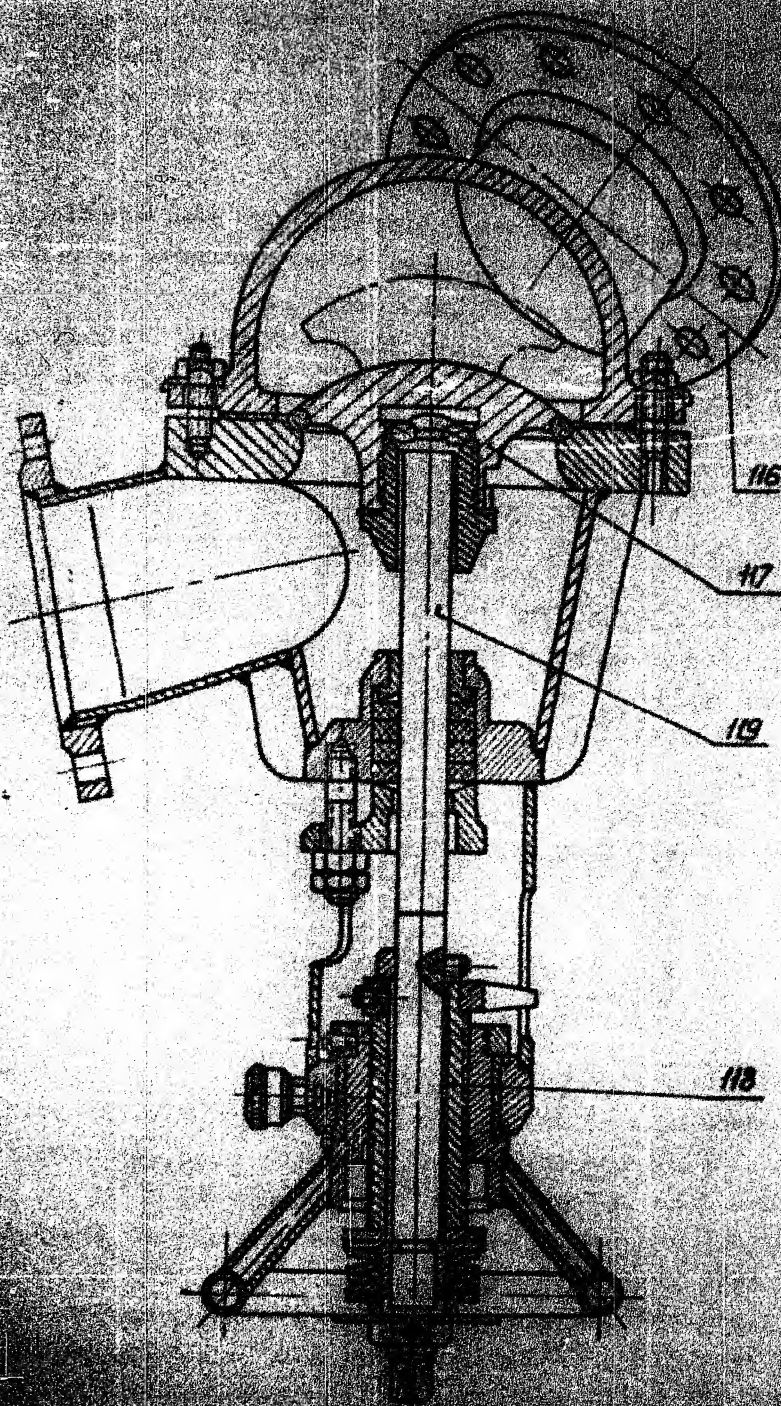


FIG. 13. DIESEL COMPRESSOR WITH EXHAUST VALVE
116-118, 119-120, 121-122, 123-124, 125-126, 127-128, 129-130, 131-132, 133-134, 135-136, 137-138, 139-140, 141-142, 143-144, 145-146, 147-148, 149-150, 151-152, 153-154, 155-156, 157-158, 159-160, 161-162, 163-164, 165-166, 167-168, 169-170, 171-172, 173-174, 175-176, 177-178, 179-180, 181-182, 183-184, 185-186, 187-188, 189-190, 191-192, 193-194, 195-196, 197-198, 199-200, 201-202, 203-204, 205-206, 207-208, 209-210, 211-212, 213-214, 215-216, 217-218, 219-220, 221-222, 223-224, 225-226, 227-228, 229-230, 231-232, 233-234, 235-236, 237-238, 239-240, 241-242, 243-244, 245-246, 247-248, 249-250, 251-252, 253-254, 255-256, 257-258, 259-260, 261-262, 263-264, 265-266, 267-268, 269-270, 271-272, 273-274, 275-276, 277-278, 279-280, 281-282, 283-284, 285-286, 287-288, 289-290, 291-292, 293-294, 295-296, 297-298, 299-300, 301-302, 303-304, 305-306, 307-308, 309-310, 311-312, 313-314, 315-316, 317-318, 319-320, 321-322, 323-324, 325-326, 327-328, 329-330, 331-332, 333-334, 335-336, 337-338, 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2459-2460,

Carbon deposits are removed from the packing margins of the coaming and the disc by means of rotation of stem 119 with the valve being closed. Tight fitting of disc 117 to the coaming during cleaning the packing margins is ensured by the disc springs.

The valve body and pressure cap 116 are made of steel.

For the thermal protection the outer surfaces of the body and cap are covered with asbestos cord.

The assembled valve has been tested for watertightness at a hydraulic pressure of 38 kgf/cm^2 built up from the side of the over-valve space.

Gate Valve

(Fig.14, Appendix 1)

Gate valve 138 is used for starting diesel-compressor EM-2 in snorting with discharge of exhaust gases into the compartment.

The gate valve is closed and opened by manual rotation of the hand wheel. The valve position is indicated by the mechanical indicator.

Thermal protection of the gate valve is obtained by means of an asbestos cord applied to the outer surface of the gate

Draining Pipelines

(Appendices 1 and 2)

The draining pipelines are intended for draining water from the over-valve spaces of inner flaps 128 and 129 and from the water catchers of compensators 126 of the wing snort exhaust systems into the bilge well of compartment V.

The pipelines are composed of the red copper pipes and are furnished with the fittings made of bronze.

The pipes running from the inner flaps to valves 151 have been tested for watertightness at a hydraulic pressure of 35 kgf/cm^2 ; the pipes running from the water catchers of the compensators to cocks 154 have been tested at a hydraulic pressure of 1.0 kgf/cm^2 .

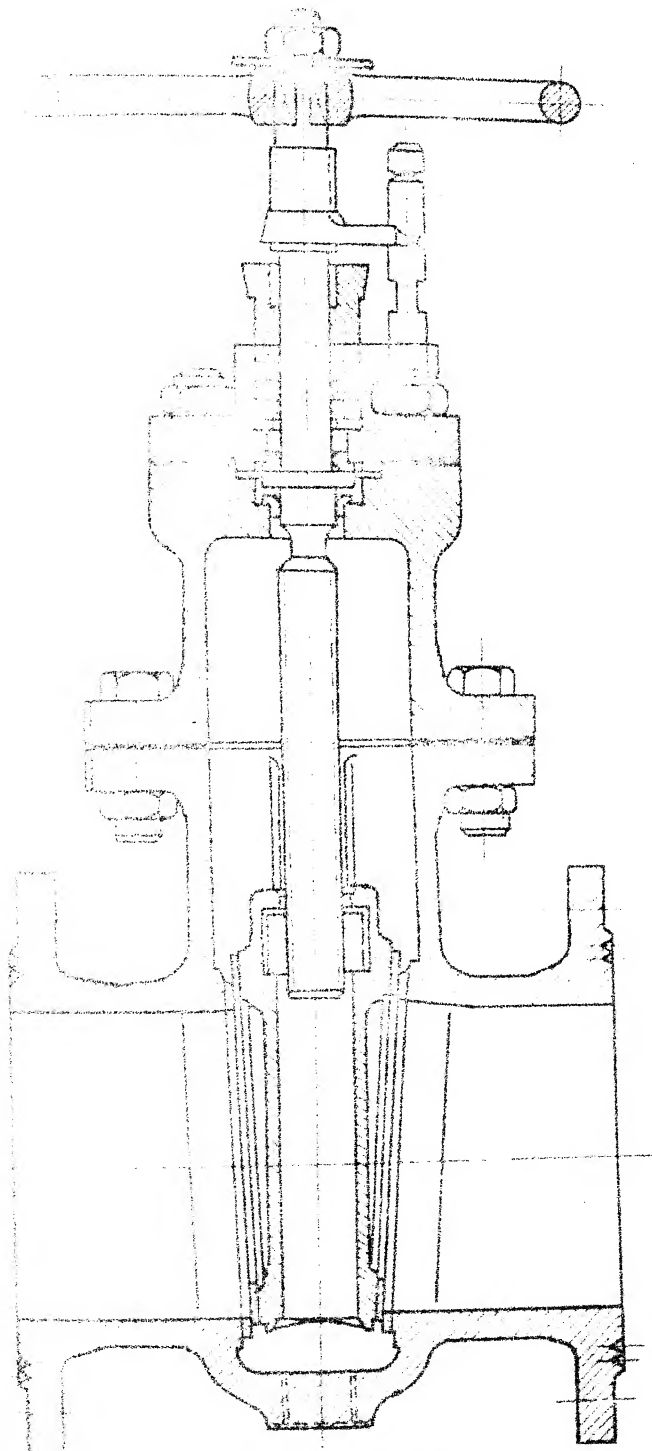


FIG. 14. GATE VALVE

31

50X1-HUM

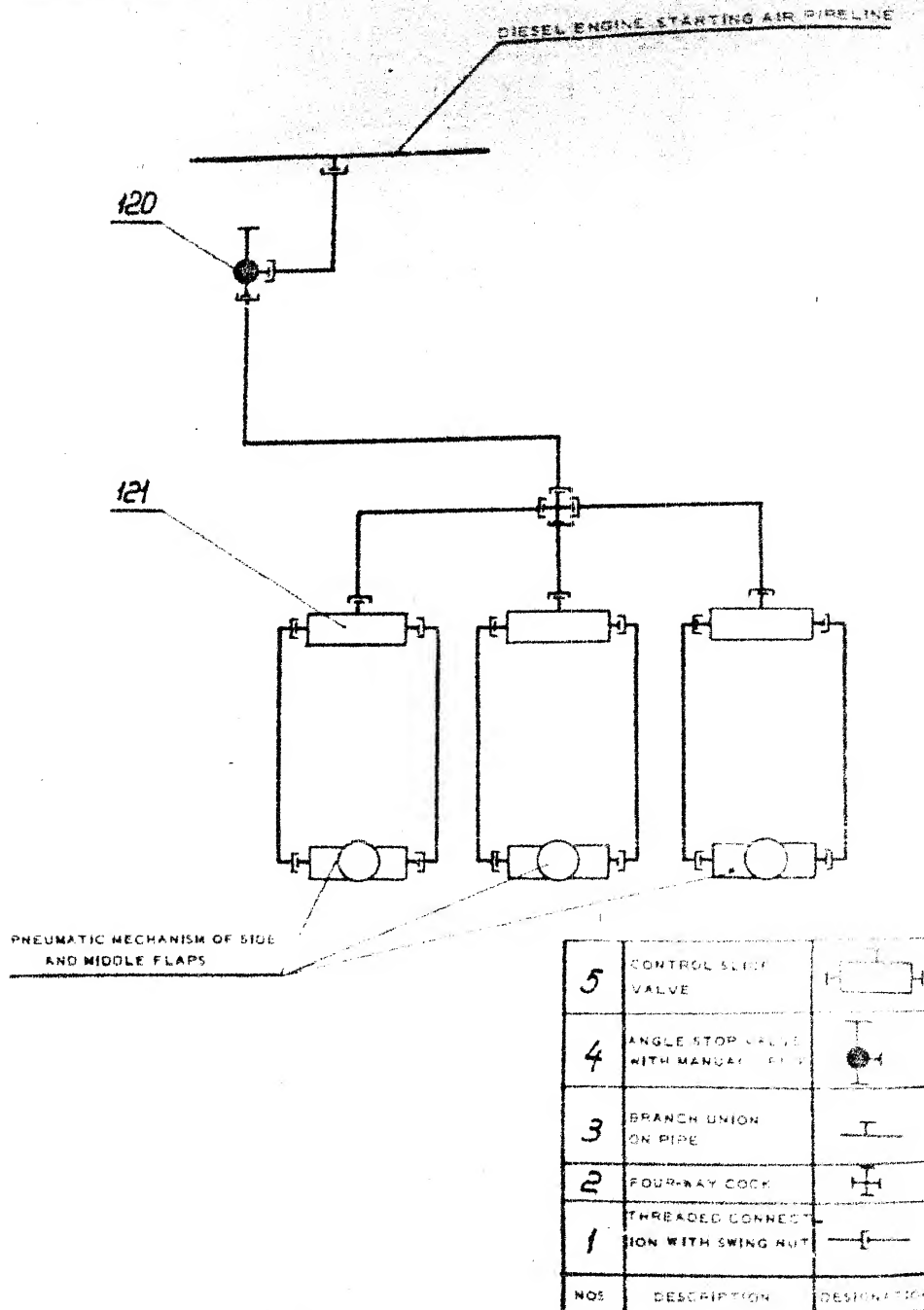


FIG. 15. KEY-DIAGRAM OF SNORT EXHAUST SYSTEM INNER FLAP CONTROL AIR PIPELINE
 120—stop valve; 121—control slide valve

Flaps joints of the pipelines are assembled with the support brackets.

Air Pipeline

(Fig.15)

The air pipeline is intended for controlling the pneumatic control of short exhaust system inner flaps 123 and 129.

Air is fed from the starting air pipeline of the diesel engine through angle stop valve 120 to control slide valves 121.

The control slide valves are used to control the pneumatic control of the inner flaps (for the description of the control slide valve, see "Description and Operating Instructions of the Engine Air Feeding System").

The air pipeline is composed of the red copper pipes and is tested at a pressure of 35 kgf/cm².

2. CONTROL INSTRUMENTS AND SIGNALLING SYSTEM

(Appendix 1)

Instrument name and type (set)	Type of pick- up	Place of in- stallation of instrument, board name	Note
Extreme positions of outboard outer flap (1st lock)	3CC	Control post of compart- ment V and conning station	In open posi- tion of flap, dull lamps light
Extreme positions of inboard outer flap (2nd lock)	3CC	Signal boards	In closed po- sition of flap, green lamps light
Extreme positions of outer flap of centre diesel engine (1st lock)	3CC		

Location, name and type of instrument (set)	Type of pick-up	Place of installation of instrument, board name	Note
Extreme positions of starboard inner flap (starboard lock)	3CC	Control post of compartment V and conning station	In open position of flaps, dull lamps light
Extreme positions of port side inner flap (starboard lock)	3CC	Signal boards	In closed position of flaps, green lamps light
Extreme positions of the inner flap of the starboard end (starboard lock)	3CC		

TESTING OF THE SYSTEM

TESTING OF THE SYSTEM

TESTING OF THE SYSTEM

1. Before the start of the test, check every
part of the system exhaust system and filter flaps 133
and 139 in the following way:

2. Open flaps 133 and 139 and drain valves 131 and in-
spect them for air-tightness;

3. Open flaps 133 and 139 and drain valves 131, open
flaps 133 and inspect flaps 133 and 139 for air-

4. The system should be considered airtight if the pressure
does not exceed the rated values specified for
the hydraulic test.

5. Check the friction surfaces and parts of the
system of the hydraulic and pneumatic mechanisms
for airtightness.

6. Check the operation of filter flaps 133 and 139 for proper
operation. The allowable operating pressure of oil
is not greater than 10 kg/cm². For this purpose
the control valve should be opened and closed the
system. Check mechanical indicators 140 and 141
for the "CLOSE" position, the notches of in-
dicator 140 should be at the "TOP" and word OPEN (ОТКРЫ-
ТО) should be at the notch with the word CLOSE (ЗА-
КРЫТО) position, the notches of indicator 141
should be at the "TOP" and word OPEN (ОТКРЫТО) and
the notches of indicator 141 should be at the notch with latter
word. For the operation of the flaps should
be checked.

7. After the flaps 133 and 139 are checked for normal
operation the pump is being operated and the storage bat-
tery is disconnected. According to
the program the control valves in this case should be

the closed position. If the linkage does not operate properly, at an oil pressure of 70 kgf/cm², detect and eliminate the cause.

When the oil enters into the path of flaps during the opening and closing the flaps to preclude the possibility of scoring the bearing shells made of hardened plastic of flaps 133 and 139. The flaps 133 and 139 for proper operation of the flaps with the help of control slide.

When the operation of the mechanical indicators is checked, the notch with letter "O" on cam 29 with pointer 38 while in the "CLOSED" position. Pointer "B" on cam 29 should coincide with pointer 38. The operation of the flaps should not be affected.

The pressure in the pneumatic system required for opening and closing the flaps is about 70 kgf/cm².

If the flaps do not operate properly, detect and eliminate the cause.

When closing and opening flaps 133 and 139, 138 and 139, the light signals correspond to the position of the mechanical indicators on hydraulic mechanisms 25.

When the operation:

When the crank mechanism - the green signal lamps should light when the crank shaft passes over the lower dead point. The dull signal lamps should light when the crank shaft is at a distance of 2° from the upper dead point.

When the pneumatic mechanism - the green signal lamps should light when the notch with letter "B" on cam 29 coincides with pointer 38. The dull signal lamps should light when the notch with letter "O" on cam 29 coincides with pointer 38.

If the operation is improper, the signalling system should be checked in accordance with the "Signalling System Description and Instructions".

... linkage does not operate properly, detect and eliminate the fault.

... the bath of flaps during the operation of the flaps to provide the necessary pressure on the bearing shells made of ... the flaps 133 and 139.

... flaps 133 and 139 for proper operation by ... the flap with the help of control slide ...

... the operation of the mechanical ... the notch with letter "O" on cam 29 ... pointer 38 while in the "CLOSED" position ... letter "Q" on cam 29 should coincide with pointer 38.

... the air required for operation of the flaps should not ...

... pressure in the pneumatic system required for operation of the flaps is about 28 kgf/cm².

... the linkage does not operate properly, detect and eliminate the fault.

... closing and opening flaps 133 and 139, 135 and 137 ... the light signals correspond to the position indicated by the mechanical indicators on hydraulic mechanisms 24 and pneumatic mechanisms 25.

In case of proper operation:

(a) for the hydraulic mechanisms - the green signal lamps should light when the mechanism crank shaft passes over the lower dead point and the dull signal lamps should light when the crank shaft is at a distance of 2° from the upper dead point;

(b) for the pneumatic mechanisms - the green signal lamps should light when the notch with letter "B" on cam 29 coincides with pointer 38 and the dull signal lamps should light when the notch with letter "O" on cam 29 coincides with pointer 38.

In case of improper operation, the signalling system should be adjusted in accordance with the "Signalling System Description and Operating Instructions".

Initial Position

1. Flaps 131, 132 and 133, outer flaps 133 and 139, and the Diesel-compressor short exhaust system and the flaps 134 are closed.
2. The water valve 132 is open.
3. Valves 131 and cocks 135 are open.
4. Hydraulic mechanisms 137 are locked and the tooth of crank 142 and clutch gear 143 are disengaged.
5. The control valves of hydraulic mechanisms 137 are set to the middle position.
6. Valve 130 on the air pipeline is closed.

B. STARTING, SERVICING IN OPERATION AND SETTING OUT OF OPERATION

Starting

Discharge of exhaust gases when the submarine is
cruising on the surface

Notes: 1. The sequence of operations given below relates to one diesel engine. When it is necessary to start or stop two or three diesel engines simultaneously, the mentioned operations should be performed in the same sequence, in turn for each diesel engine.

2. When warming up the diesel engines, feed water for cooling the short exhaust system and the flaps.

3. Feed water to the short cooling system in accordance with the "Description and Maintenance Instructions for Sea Water Cooling Pipeline of Diesel Engine and Diesel-Compressor Short Exhaust System, Heat Exchangers and Shaftings".

Caution: Hasty feeding of water for cooling the short exhaust system may result in damaging the packing rubber rings and bushings of the bearings of flaps 133 and 139.

4. Open the valve separating the compressed air reducer of the starting air system from the high pressure air pipeline and the opening of the valve behind the reducer (see Instruc-

12. Open the starting air pipeline system of the main diesel engine, (ref. Nos 72 and 73 on the diagram).

13. Open valve 130 of the air pipeline.

14. Remove stopper 82 from the hydraulic mechanism.

15. Close ventilation valve 132.

16. Make sure that valve 131 and cock 125 are open and water does not flow from them.

17. Move the handle of control slide valve 131 to the "OPEN" position and open inner flap 128.

Make sure that the flap is opened, for which purpose watch the light signal in compartment V.

If the signal lamp does not light, open the manual reducing valve in accordance with instructions for starting air. After the opening of the flap, close manual reducing valve, detect and eliminate the faults.

If the signal lamp does not light, determine the position

of the flap with the help of the mechanical indicator of the pneu-

matic system.

18. To eliminate the faults in the 1st step, proceed in accordance with the "Description and Maintenance of the Starting Systems";

19. If the flap does not open, open it manually for which purpose:

- open valve 130 of the air pipeline;

- reduce pressure in the pneumatic mechanism cavity, shift

slide valve 131 to the "CLOSED" position

and return the handle to the "OPEN" position;

- put the lever at the square of shaft 53 of the pneumatic mechanism in such a position so that the notch with letter "O" on cam 2 is in contact with pin 70. This does not take the lever away;

- open valve 130 of the air pipeline.

After the flap has been opened, detect the faults and eliminate them.

19. Prepare flap 133 for opening. To this end, do the following:

- make sure that bottom of cock 141 is disconnected from pin 142.

continuous damage of the diesel engine, continuous-ly watch that there is no water in the snort exhaust system during starting the diesel engine. Therefore, prior to each starting, inspect the drain pipelines for absence of leakage.

Overboard Discharge of Diesel-Compressor MK-2 Exhaust Gases When Submarine is on the Surface and Diesel Engine 2M42 Does Not Operate

23. Make sure that water does not pass through valve 151. Open cock 154 on the muffler and drain condensate.

24. Perform the operations mentioned in Items 12, 15, 16 and 19 of the present Instructions.

25. Open valve 153 and outer flap 133 in accordance with instructions given in Item 20.

26. Start diesel-compressor MK-2 in accordance with instructions on servicing the diesel-compressor.

27. Immediately, after starting the diesel-compressor, close valve 151 and cock 154 on the muffler.

Note: When it is necessary to operate the diesel engine or the diesel-compressor with the discharge of gases to the atmosphere, prior to starting the diesel engine or the diesel-compressor remove a stopper from the branch pipe on pipe 136 of the respective side and put it on its place again when the operation has been completed.

Discharge of Diesel Engine Exhaust Gases When Snorting or When Scavenging the Main Ballast Snort Exhaust System in Initial Position)

28. Make sure that valve 151 and cock 125 are open and water can flow from them.

29. Perform necessary operations with the fittings of the cooling pipeline in accordance with the "Description and Maintenance of the Cooling System for Sea Water Cooling Pipeline of Diesel Engine and Diesel-Compressor Snort Exhaust System, Heat Exchangers and Shaft-

12. Make sure that in the closed position of flap I33 hydraulic cylinder I37 is locked with stop 82.

13. Open inner flap I28. To do this, proceed in accordance with instructions given in item 18.

14. Also according, the opening of the flap is determined in accordance with instructions for the snort system.

15. The further operations on starting the diesel engine and assisting are performed in accordance with instructions for the snort system.

16. When preparing the exhaust pipelines for operation of the diesel engines to scavenge the main ballast, set the non-return controlled flaps of the snort system to the "NO-RETURN" position.

17. The further operations should be performed in accordance with the "Description and Instructions for Scavenging of Main Ballast by Pressure Air".

18. When one or two diesel engines operate for scavenging the main ballast, the exhaust pressure should not exceed 1.5 kgf/cm^2 , as read by the pressure gauge installed at the coupling station.

Starting of Diesel-Compressor AK-2 Exhaust Gases When Diesel Engine 2142 Operates (in Snorting and on Surface)

19. Drain water from the muffler through cock I54 and open the I3.

20. Start the diesel-compressor in accordance with instructions for starting the diesel-compressor.

21. In case AK-2 would not be started with the exhaust of gases, open gate valve I38 and start AK2 with the discharge of gases into the compartment. As soon as the operation of AK-2 becomes stable, open valve I53 and close gate valve I38.

22. When the submarine is at the periscope depth, the diesel-compressor may operate together with the main diesel engine of the given side only.

Servicing in Operation

39. See that exhaust gases do not leak through compensators 126, 127, 149 and 150.

In case of gas leakage, proceed in accordance with instructions given in Item 54.

40. Periodically open cock 125 and drain water from the water catcher of compensator 126.

Setting out of Operation

41. When the fuel delivery is stopped and the diesel engine speed decreases to 286 r.p.m., set the control valve handle to the "CLOSED" position to close flap 133.

Make sure that flap 133 is closed (by the light signals in compartment 7) and shift the control valve handle to the middle position.

Note: In case the light signal is absent, close inner flap 133 by means of control slide valve 121 and simultaneously close flap 133 by hand. For this purpose proceed as follows:

- communicate the pressure and drain lines of hydraulic mechanism 137 by setting the slide valve to the "BY-PASS" position;

- mesh the tooth of ratchet 142 with ratchet gear 143;

- set the ratchet-wrench on crank shaft 80 of the hydraulic mechanism and turn it so as to match the notch with letter "3" on indicator 140. This done, take ratchet wrench away;

- after closing outer flap 133, disconnect the tooth of ratchet 142 from ratchet gear 143 and set the slide valve of the hydraulic system to the "HYDRAULIC" position.

Caution! Disengage the tooth of ratchet 142 from ratchet gear 143 after closing the outer flap manually to avoid damage during operation of the hydraulic system.

Note: Report to the conning station that the hydraulic system is out of order and operate on commands.

42. Close inner flap 128 by turning the handle of the control valve to the "CLOSED" position. Make sure that the flap is closed by the light signals in compartment V.
43. If the light signal is absent, open manually-controlled re-ventilation valve in accordance with instructions for starting air.
44. After the flap has been closed, close the manually-controlled re-ventilation valve.
45. If the green lamp does not light, use the mechanical indicator on the pneumatic mechanism to find out the position of the flap:
46. If the flap is closed, eliminate faults in the light signaling system.
47. If the flap is open, close it manually in the following order:
 - a. Close valve 120 of the air pipeline;
 - b. Turn the handle of control slide valve 121 to the "OPEN" position; after previously decreased pressure in the pneumatic line has been equalized and return the handle to the "CLOSED" position;
 - c. Turn the lever on shaft 53 of the pneumatic mechanism, turn the control notch "3" on bar 29 is matched with pointer 38.
 - d. After this, take the lever away;
 - e. Open valve 120 of the air pipeline.
48. After the flap has been closed, detect and eliminate the faults.
49. Using ratchet of the air supply valve, clean the packing surfaces of the coaming and the flap disc; for this purpose turn the flap disc clockwise and counterclockwise for at least 100 complete revolutions.
50. Open valve 151 and cock 125.
51. Put the stop on hydraulic mechanism 137.
52. Disconnect the cooling water feeding system in accordance with the "Description and Maintenance Instructions for Sea Water Cooling Pipeline of Diesel Engine and Diesel-Compressor Short Exhaust System, Heat Exchangers and Shaftings".
53. After stopping the last operating diesel engine, open ventilation valve 132.
54. Close valve 120 of the air pipeline.

After the operation of the diesel-compressor is over, perform the following:

- perform the operations mentioned in Items 41, 45, 46

47.

- Close valve 151, set the wrench on the square of stem 119, clean the packing margins of the coaming and the valve disc; open valve 151.

48. After the operation of the diesel engines in snorting has been completed, do the following:

- perform the operations required for disengagement of the snort system in accordance with the "Description and Servicing of Snort System";

- at the moment determined by the Instructions for the snort system, close inner flap 128 in accordance with the directions given in Item 42 of the present Instructions and close the air pipeline:

- open valve 151 and cock 125.

49. After the operation of the diesel-compressor in snorting has been completed, close valve 153, set the wrench on the square of stem 119 and clean the packing margins of the coaming and the valve disc.

G. MAINTENANCE DURING PROLONGED STANDSTILL

The prolonged standstill essentially is a period when the machine is subjected to the running or medium repairs.

50. Drain the snort exhaust system and cooling cavities of all the units of the snort exhaust pipes.

51. Inspect the equipment of the snort exhaust system, except for the disassembled units in accordance with the requirements specified in Section "E" of the present Instructions.

7. TROUBLES AND REMEDIES

Trouble	Possible cause	Remedy on board
Gas leakage in "sleeve-body" flange joint of compensator	Loosening in "sleeve-body" flange joint	Tighten up bolts of flange joints near flexible coupling to eliminate gas leakage
Water leakage through drain valves 131 and 133 and 139	(a) Damaged packing rings of outer flaps 133 and 139 (b) Linkages 131 of outer flaps are not adjusted (c) Wrong setting of adjusting bolts 85 and limiting straps 97 of hydraulic mechanisms (d) Heavy water leakages in cooling cavity of the short exhaust pipe	(a) Replace packing rings (b) Tighten up or loosen rigging screws of linkages (c) Adjust bolts 85 and limiting straps 97 (d) Detect and eliminate leakages
Gas leakage in flange joints of short exhaust system	Flange joints loose	Tighten up bolts of flange joints

Trouble	Possible cause	Remedy on board
Oil leakage from cylinders of hydraulic mechanism 137	(a) Collars of piston groups damaged (b) Cylinders-to-body and covers-to-cylinders fastenings, loose	(a) Replace collars (b) Tighten up fastening nuts
Air and oil leakage in packing rings of pneumatic mechanism 25	(a) Packing rings damaged (b) Fastening of cylinder covers, loose	(a) Replace packing rings (b) Tighten up nuts fastening covers to cylinders
Leakage of sea water through packing of shaft of hydraulic mechanism 137	Packing rings 75, damaged	(a) Tighten up stuffing box 17 when submarine is under water (b) Replace packing rings 75 when submarine is on surface
Hydraulic pressure about 72 kgf/cm ² inner flap 133 fails to be closed or opened	(a) Linkage 131 is not adjusted (b) Binding of flap shaft	(a) Using winging screw, adjust linkage (b) Inspect wooden-laminated plastic shells 63 and 65 of flap bearings
Inner flap 133 can not be fully opened or closed	(a) Wrong setting of buffers 68 of flap (b) Packing ring 58, burnt out	(a) Set buffers of required height (b) Inspect rubber packing ring 58

Problem	Possible cause	Remedy on board
Failure of inner flap 128 during closing	Adjusting bolt 33, loose	Remove cover 15 and obtain clearance between bolt 39 and disc to ensure free rotation of disc
Inner flap 128 fails to be closed	(a) Carbon deposit on packing margins of coaming and flap disc (b) Wrong setting of disc springs 33 in rest 37	(a) Remove carbon deposit from packing margins (b) Set springs 33 in rest 37 properly by adjusting them through tightening of bolt 35
Corrosion of fastening parts	Insulation damaged or absent	Remove corrosion from parts, restore insulation (using bushings and gaskets). Replace heavily damaged fastening parts

INSPECTIONS AND REPAIRS

Daily Inspections

- 1. Daily inspect all the mechanisms and fastenings.
- 2. Inspect the cavities of the short exhaust system for water.
- 3. Check and test all the flaps and valves of the short exhaust system for proper opening and closing.
- 4. Check the packing margins of inner flaps 128, 129 and 130.
- 5. Check the inner flaps 128, 129, 133 and 139 to check the opening and closing systems for proper operation.

Weekly Inspections

Perform all the operations listed in the "Daily Inspections" section and besides do the following:

- 70. Tighten up the flange joints of the short exhaust system, if necessary.
- 71. Tighten up the stuffing box of manual linkage 125 and replace its packing, if necessary.
- 72. Tighten up the cap lubricators to lubricate the bearings of crank shaft 80. Use a grease gun to lubricate pins of articulated rod 86 and lower guide bushing of the hydraulic mechanism stem.
- 73. Lubricate the friction surfaces of inner flaps 124 and 129.
- 74. Press out and replenish lubricant in the cap lubricators and mechanical plunger lubricators.

Monthly Inspections

Perform all the operations listed in the "Weekly Inspections" section and besides do the following:

- 75. Inspect the packing rings of outer flaps 123 and 128.
- 76. Check the rubber flexible sleeves of the compensators for absence of gas leakage at a pressure of 1.5 - 2 kgf/cm².
- 77. Clean and blow off the water drain pipes and valves of the short exhaust system.
- 78. Check the flap linkages and the flap position signalling system for proper adjustment; the time and minimum pressure for their operation should be as those indicated in Items 3, 4 and 5.
- 79. Using pump BHH-90a, test water cavities of the short exhaust system in the pressure hull for air-tightness at a pressure ranging from 4 to 4.5 kgf/cm² applied through the cooling system. Use short exhaust pipe with the sea water drain valves being closed.

NOTE: When the submarine is in the offing, the inspections specified in Items 65-68, 70, 71, 75-79 can be carried out proceeding from the possibility.

Quarterly Inspections

Perform all the operations of monthly inspections and besides:

1. Open and inspect the coamings and rubber packing rings of the flaps.

2. Check the bath of outer flaps 133 and 139 for flooding of water. The cooling water level in the flap bath should be 10 mm above the packing rubber of the disc located in the lower position.

3. Remove carbon deposit from the packing margins of inner flaps 138 and 139 and valves 153.

4. Inspect collars 92 of the hydraulic mechanisms and packing rings 54 of the pneumatic mechanisms.

5. Using a grease gun, replenish grease in the cavities of pins 106 of linkage 131.

The surface of fork-insert 105 for rolling pin 106 should not be lubricated.

Half-Year Inspections

Perform all the operations specified for the quarterly inspections and besides:

1. Replenish lubricant in cavities of damper "A" of the pneumatic mechanism through a hole protected with plug 51; replenish pneumatic lubricant with graphite in cavity "E" through a hole 52; in cavity 54 and in cavity "B" after removal of plug 53.

2. Clean and lubricate the linkages of outer flaps 133 and 139; the cleaning arrangements of inner flaps 138 and 139.

3. Check the holes for leaks and make sure that lubricant is not leaking from any of the linkages and flaps.

4. Check the level of oil in the oil tank.

5. Check the level of water in the cooling water tank.

28. Check the water cavities of the snort exhaust system at an internal pressure hull for air-tightness at a pressure of 1.0 kgf/cm^2 .

29. Reassemble valves 151, cocks 125 of the draining pipelines and valve 120 of the air pipeline and check them for water- and air-tightness in the following way:

- valve 151 - at a hydraulic pressure of 38 kgf/cm^2 ;
- cock 125 - at a hydraulic pressure by water flooding;
- valve 120 - at an air pressure of 35 kgf/cm^2 .

30. Reassemble flaps 128, 129, 133 and 139.

31. Test the pressure section of the snort exhaust system at an internal hydraulic pressure of 38 kgf/cm^2 .

In this case the inner flaps, the draining valves, including the valve of low pressure blow system should be closed; the outer flaps, the bridge of snort exhaust system and the flap of low pressure blow system in the superstructure (or the low pressure pipeline) should be disconnected; the flanges of pressure pipe bends disconnected from the outer flaps, the flange on the pipe disconnected from the bridge and the flange disconnected from the low pressure pipeline should be stopped.

The pressure is connected to the pipe unions welded in the hull plugs.

Check:

- 1) the flange joints of the snort exhaust pipe running from the hull plugs to the inner flaps for air-tightness at the pressure of 1.0 kgf/cm^2 ;
 - 2) the flaps 128 and 139 together with the low pressure pipeline at a pressure of 1.0 kgf/cm^2 .
- After the test, set all the valves, cocks and fittings to their normal position.

7. REFERENCE DATA

- 1) Specify the service life of various rubber parts:
- 2) for flexible rubber sleeves of the compensators - 5 years;
- 3) for packing rings of the outer flaps, packing rings of pneumatic and hydraulic mechanisms - 5 years.

3

blowing off main ballast by low pressure air.

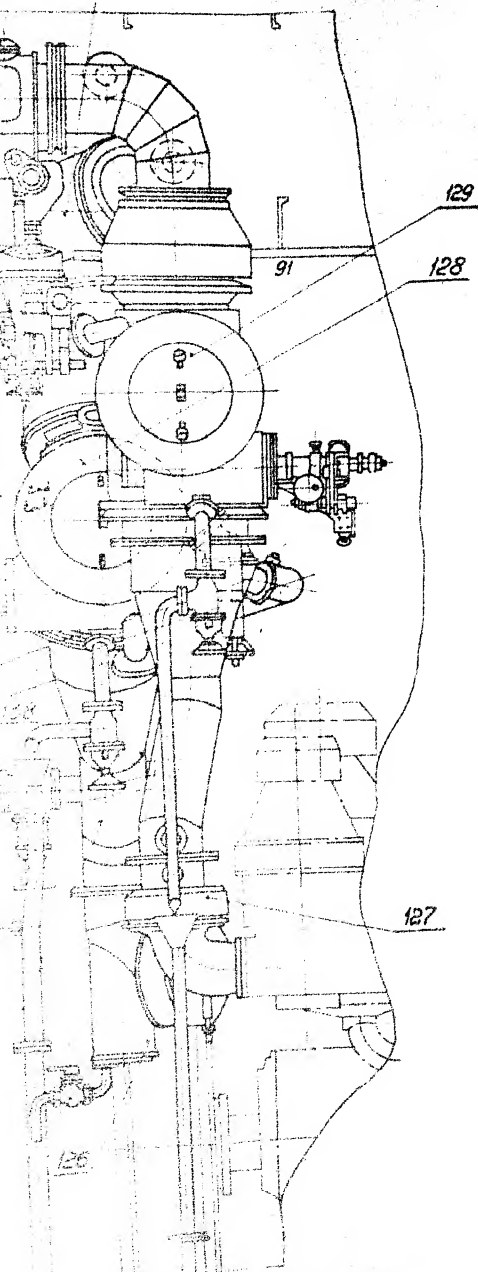
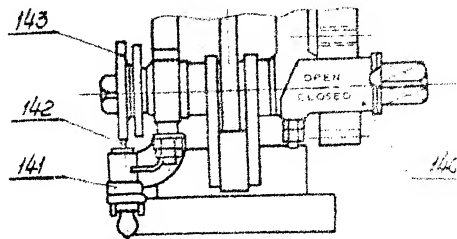
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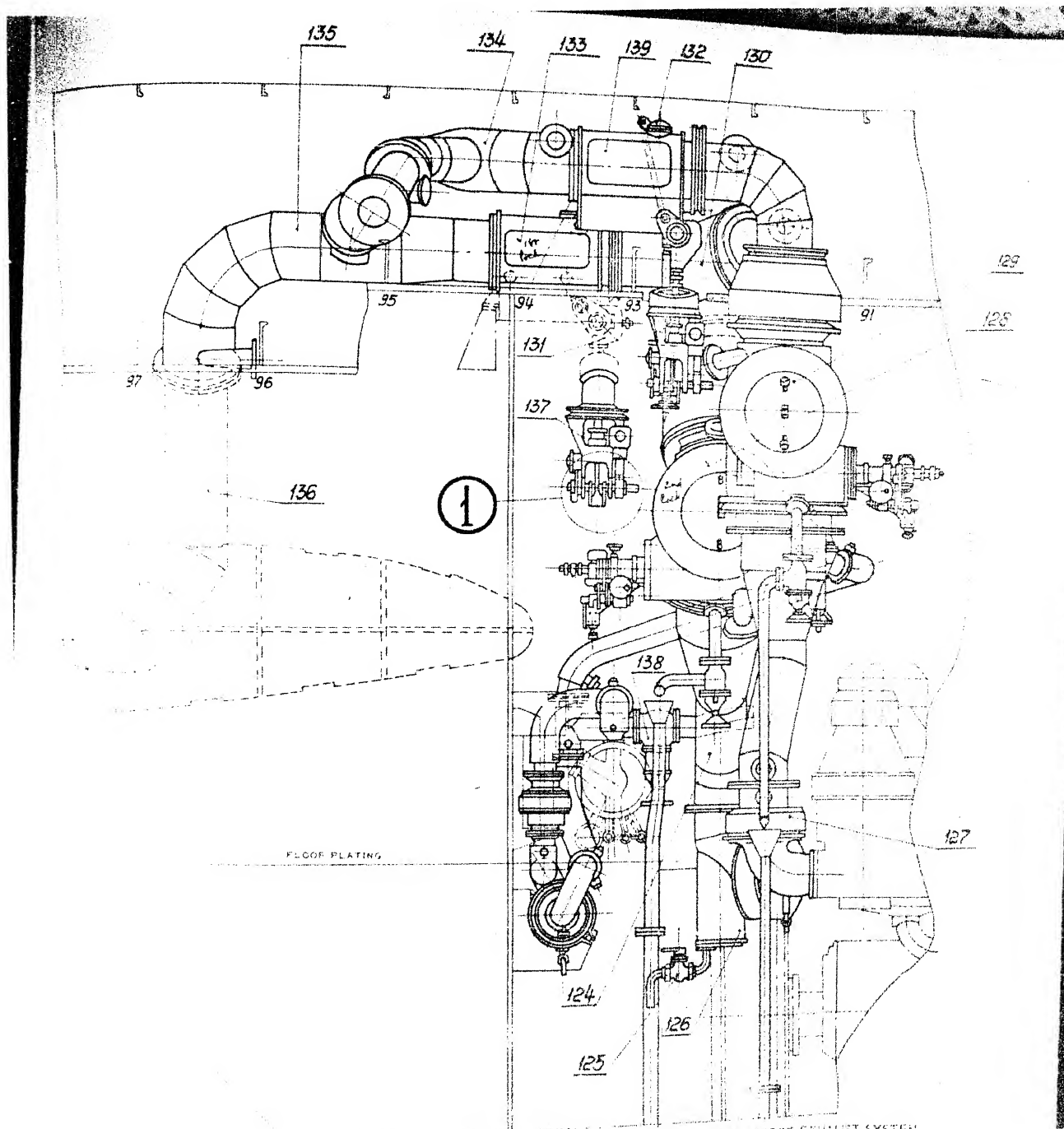
APPENDIX I

①

SETTING OF MECHANICAL
INDICATOR AND STOP

SHORT EXHAUST SYSTEM

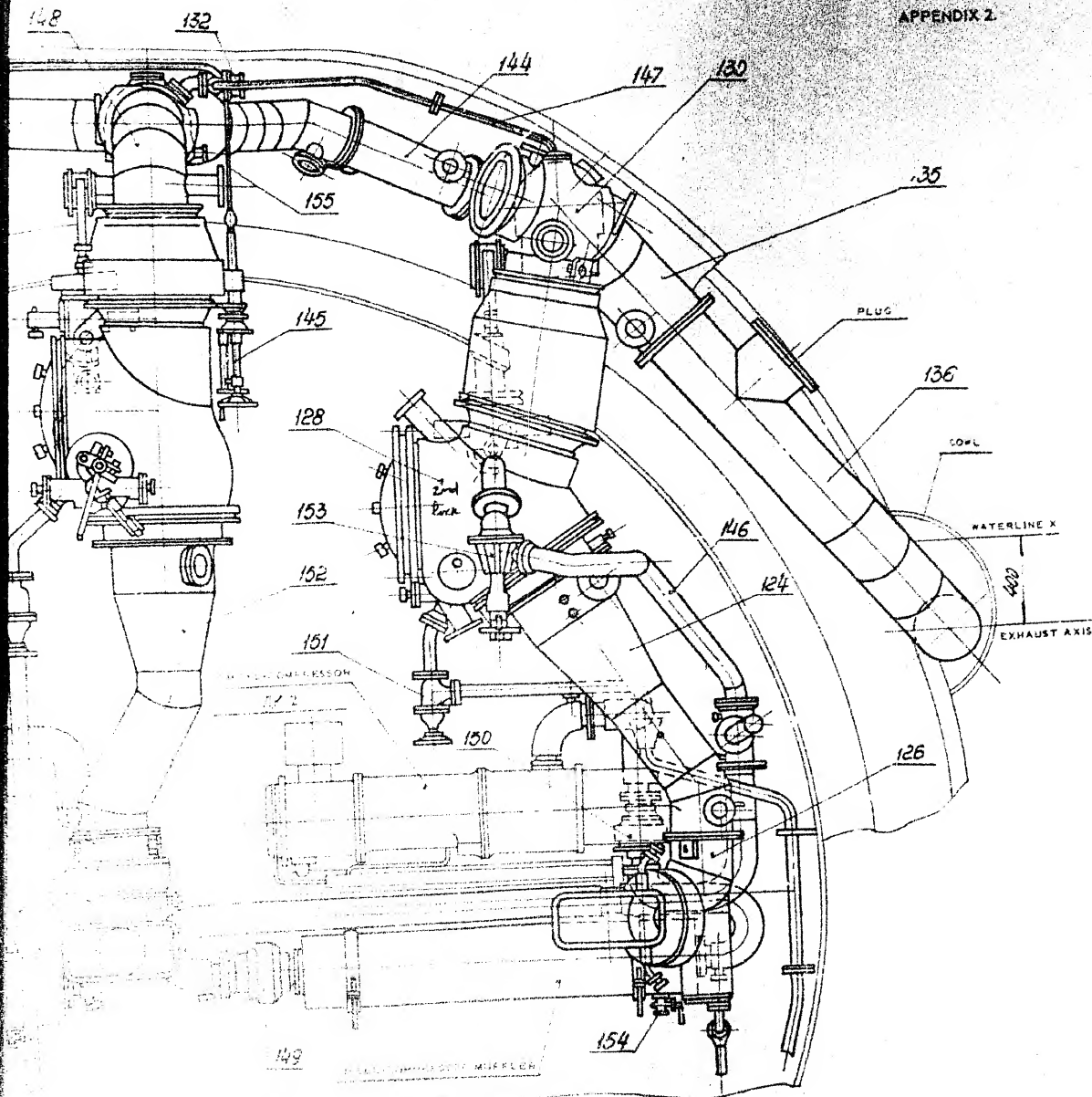
126—exhaust valve; 127—exhaust valve; 128—inner flap of wing diesel engine; 129—inner flap of centre diesel engine; 130—exhaust valve; 132—exhaust valve; 133—outer flap of wing diesel engine; 134—exhaust valve; 135—exhaust valve; 139—outer flap of centre diesel engine; 140—mechanical indicator;



GENERAL ARRANGEMENT OF SHORT EXHAUST SYSTEM
LONGITUDINAL SECTION

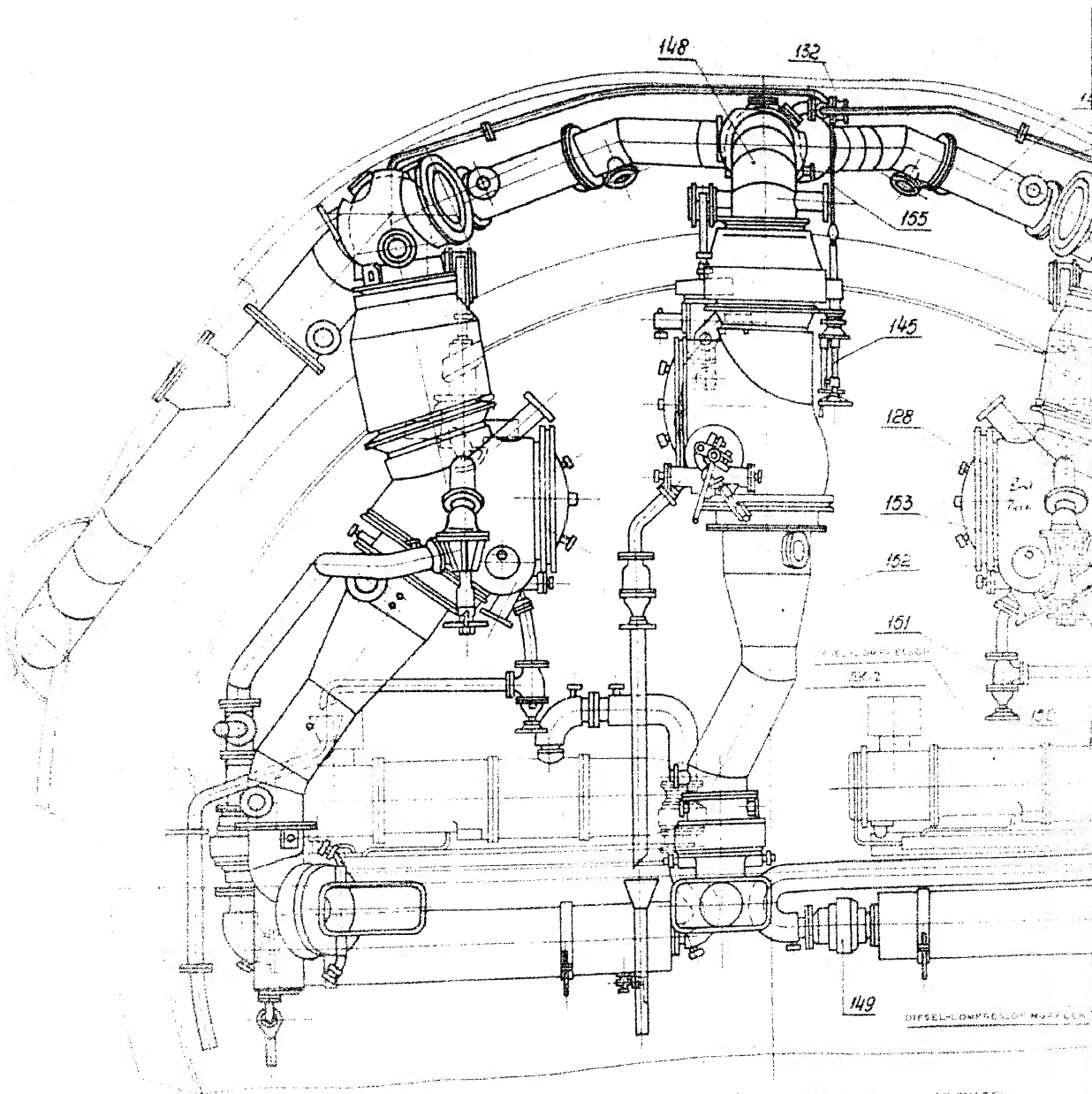
135—exhaust stack; 126—compensator; 127—compensator of centre diesel engine; 128—inner flap of wing diesel engine; 129—outer flap of wing diesel engine; 130—exhaust pipe band of wing diesel engine; 131—outer flap linkage; 132—ventilation valve; 133—outer flap of wing diesel engine; 134—exhaust pipe; 135—exhaust pipe; 136—exhaust pipe; 137—hydraulic mechanism; 138—gate valve; 139—outer flap of centre diesel engine; 140—stop; 141—stop; 142—ratchet tooth; 143—ratchet gear.

APPENDIX 2.



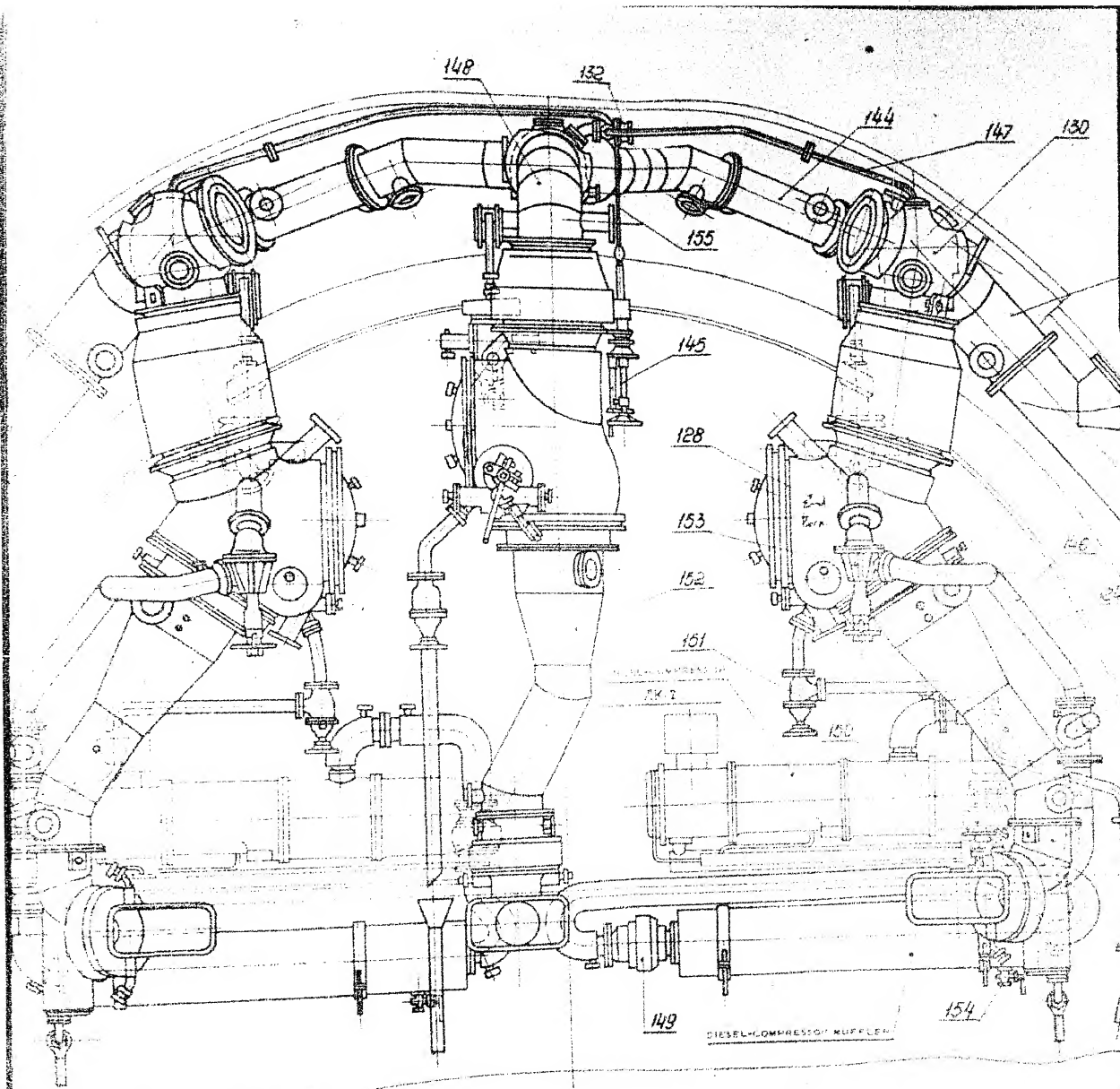
EXHAUST SYSTEM TO SPORT EXHAUST SYSTEM
 APPENDIX 2.1

148—pressure pipe bend of the
 144—exhaustion pipeline, 147—pressure pipe bend of the
 155—exhaustion pipeline, 145—exhaustion pipeline, 128—2nd lock,
 153—exhaustion pipeline, 152—inner pipe bend of centre
 151—exhaustion pipeline, 150—exhaustion pipeline, 146—exhaustion pipeline,
 124—exhaustion pipeline, 126—exhaustion pipeline, 136—exhaustion pipeline,
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GENERAL ARRANGEMENT OF SHORT EXHAUST SYSTEM
CROSS-SECTIONAL VIEW

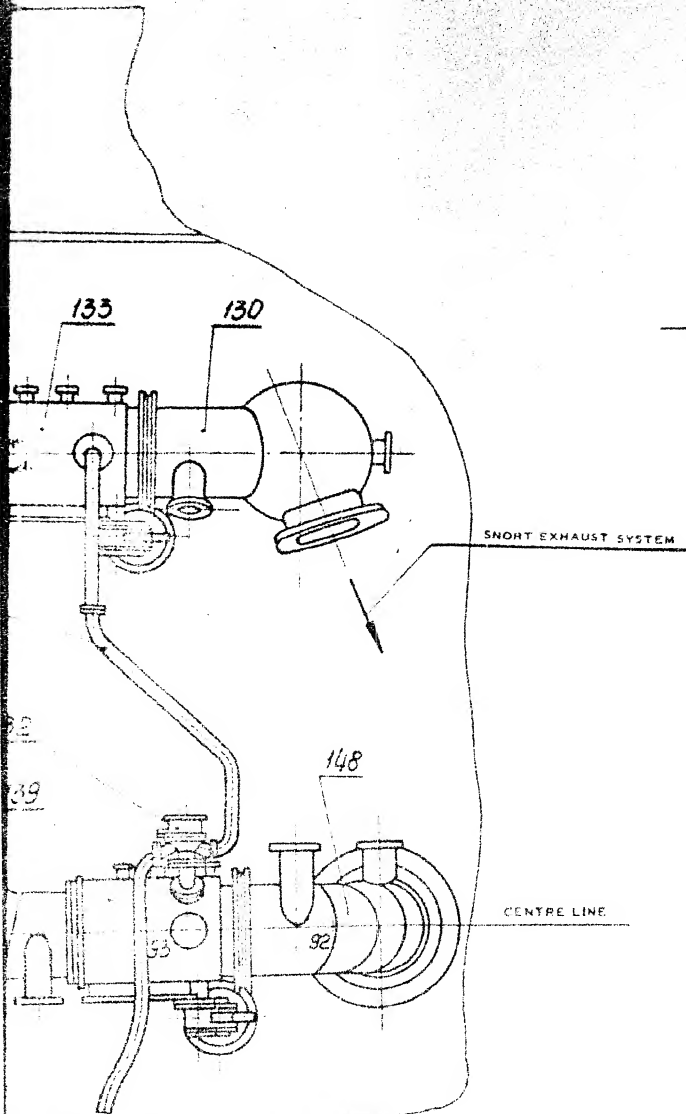
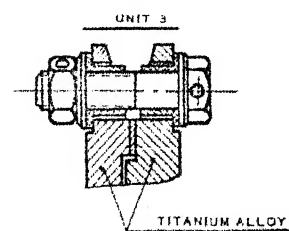
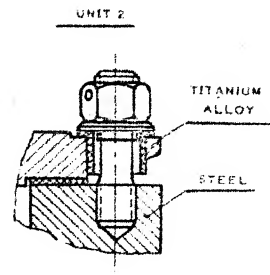
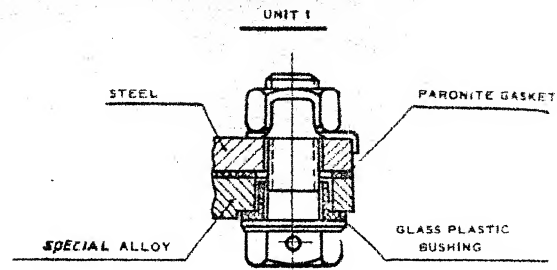
144—exhaust pipe bend of centre diesel engine; 145—manual linkage; 146—diesel-compressor pipeline; 147—ventilation pipe of diesel-compressor; 148—compensator of diesel-compressor; 149—compensator of diesel-compressor; 150—compensator of diesel-compressor; 151—drain pipeline of diesel engine; 152—short exhaust valve of diesel-compressor; 153—drain cock; 154—pulling diesel engine; 155—short exhaust valve of diesel-compressor.

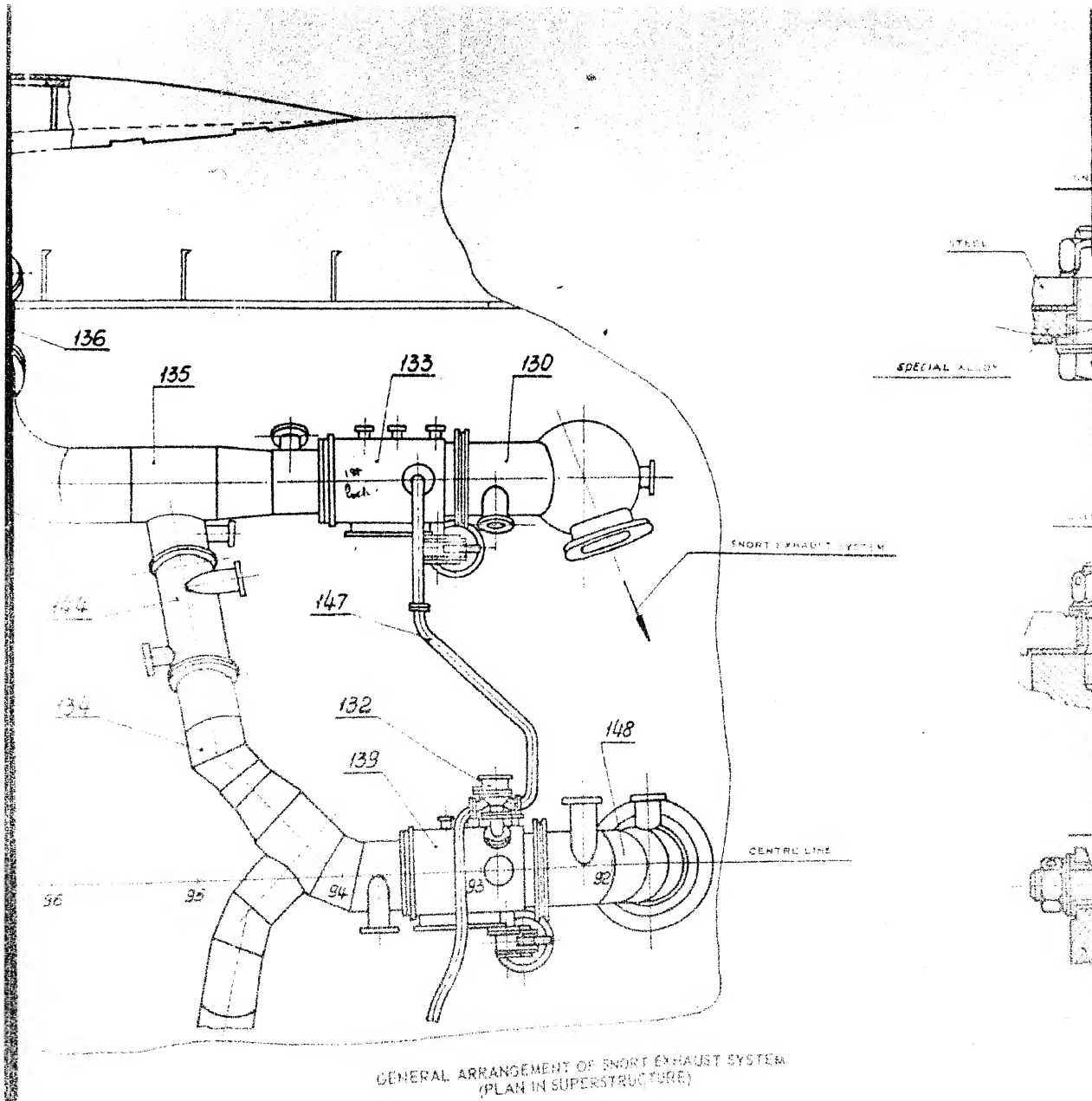


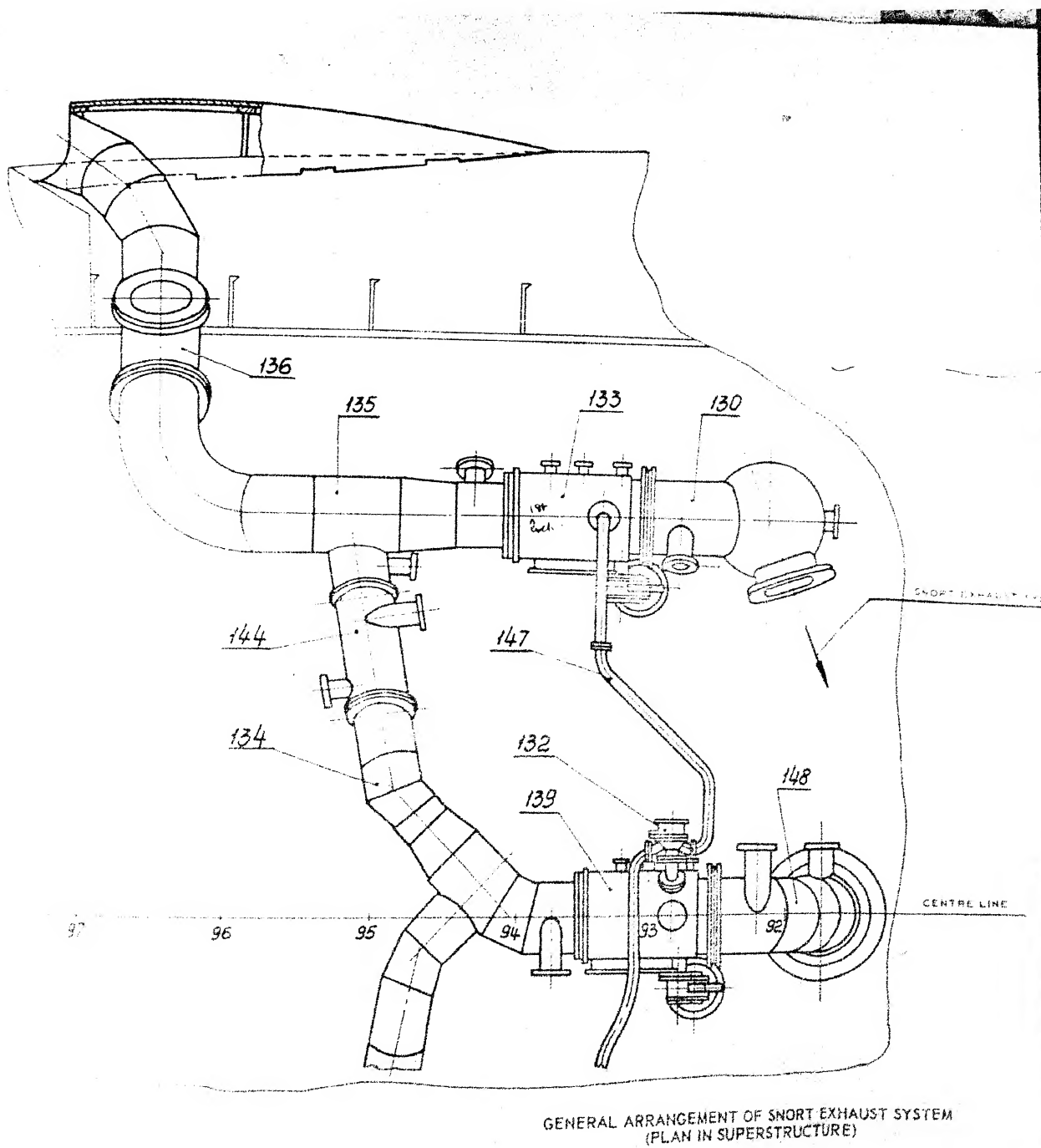
GENERAL ARRANGEMENT OF SHORT EXHAUST SYSTEM.
CROSS-SECTIONAL VIEW

144-exhaust pipe bend of centre diesel engine; 145-manual linkage; 146-diesel-compressor pipeline; 147-ventilation pipeline; 148-pressure pipe bend of centre diesel engine; 149-compensator of diesel-compressor; 150-compensator of diesel-compressor; 151-drain pipeline valve; 152-inner pipe bend of centre diesel engine; 153-short exhaust valve of diesel-compressor; 154-drain cock; 155-pulling linkage

APPENDIX 3







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50X1-HUM

VOICE COMMUNICATION PIPELINE

**DESCRIPTION AND INSTRUCTIONS ON USE
H 641- A76-276**

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50X1-HUM

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I. DESCRIPTION

A. Purpose and Basic Specifications

The voice communication pipeline serves to ensure voice communication between the combat stations of the submarine.

The voice communication pipeline inside the pressure hull is made of flange-connected brass pipes, 42x1; the pipeline connections being not fitted with gaskets.

The pipeline passing through the pressure hull into the conning tower and bridge is made of union-connected red-copper pipes, 45x2.5, whose joints are sealed with paronite gaskets.

The drum pipeline is made of union-connected red-copper pipes, 14x2, whose joints are sealed with paronite gaskets.

B. General Description and Description of Individual Units

The voice communication pipeline ensures:

(a) communication between the bridge and the control room (compartment II);

(b) between the conning tower, control room and the station of the torpedo fire control operator;

(c) between the stations in compartments III, V and VI and the bilge of the respective compartment.

The voice pipes are fitted with trumpets 5; when not used, the trumpets arranged within the conning tower sail are closed by blind plugs 4.

The voice communication pipeline passes through hull valves 3 and 7.
 7. disconnect the observation station in the conning tower from compartment III, provision is made for cock 6 on the pipeline in the conning tower.

Water is drained from the pipe arranged within the sail through two valves, dia. 5 mm, provided at the bottom of the pipe. Water remaining in the pipeline can be drained through a drain pipeline provided with a valve.

The design of the voice pipeline fittings and valves is simple, and, therefore, no special description is required.

II. INSTRUCTIONS ON USE

A. Attendance

When the submarine is at sea, the voice pipeline must be kept ready for use, i.e. the pipeline connections, valves and fittings must be tight. The valves and the cock should be easily opened and closed.

B. Preparation for Use

Initial position

In the initial position all the valves are closed.

To prepare the pipeline between the conning tower and compartment III, open valve 7 and cock 6.

To prepare the pipeline between the conning tower and compartment II, remove plugs 4 from trampets 5 and open valve 1 and 2.

C. Use of Voice Pipeline

For communication with the necessary room, dial this room and instruct the trampet by voice.

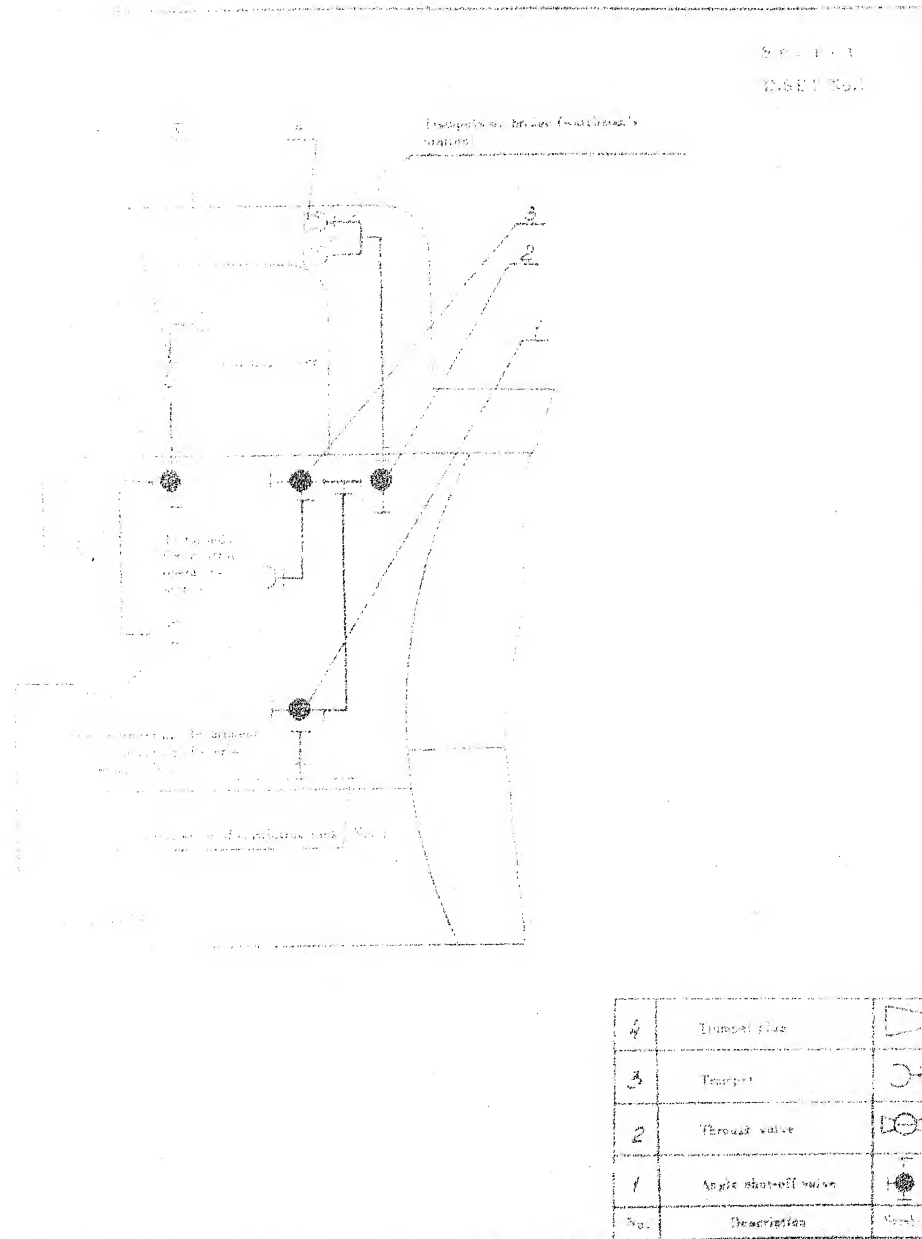
- CAUTION: 1. Before submergence, close valves 1, 2, 3 and keep them closed while the submarine is under water surface.
 2. As the submarine emerges, open valves 1, 2 and drain the water from the pipeline.

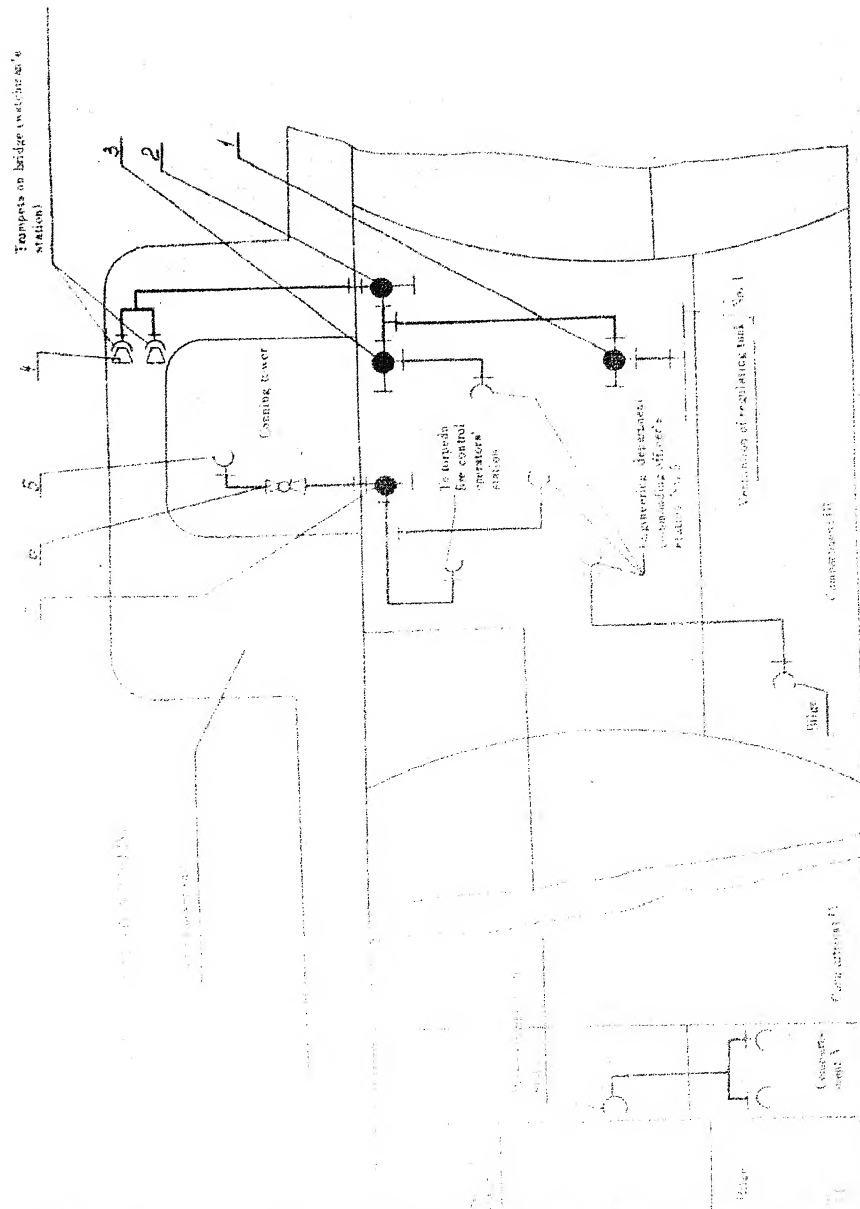
D. Troubles and Remedies

Effect	Cause	Remedy
Small amount of air in the line	Pipeline clogged	Disassemble pipe-line. Blow clogged section with compressed air

E. Preventive Maintenance

When the submarine undergoes running and medium repairs, the pipeline must be checked for tightness by a hydraulic test of 10 kg/cm² with the aid of the base hand-operated portable test pump connected to valve 1.





No.	Description
1	Angle shut-off
2	Through valve
3	Trampet
4	Trampet plug



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